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**AN ANALYSIS OF THE AQUATIC INVERTEBRATES OF TEN
STREAMS IN THE BIG HOLE RIVER WATERSHED**

June-July 2001

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A report to

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Helena, Montana**

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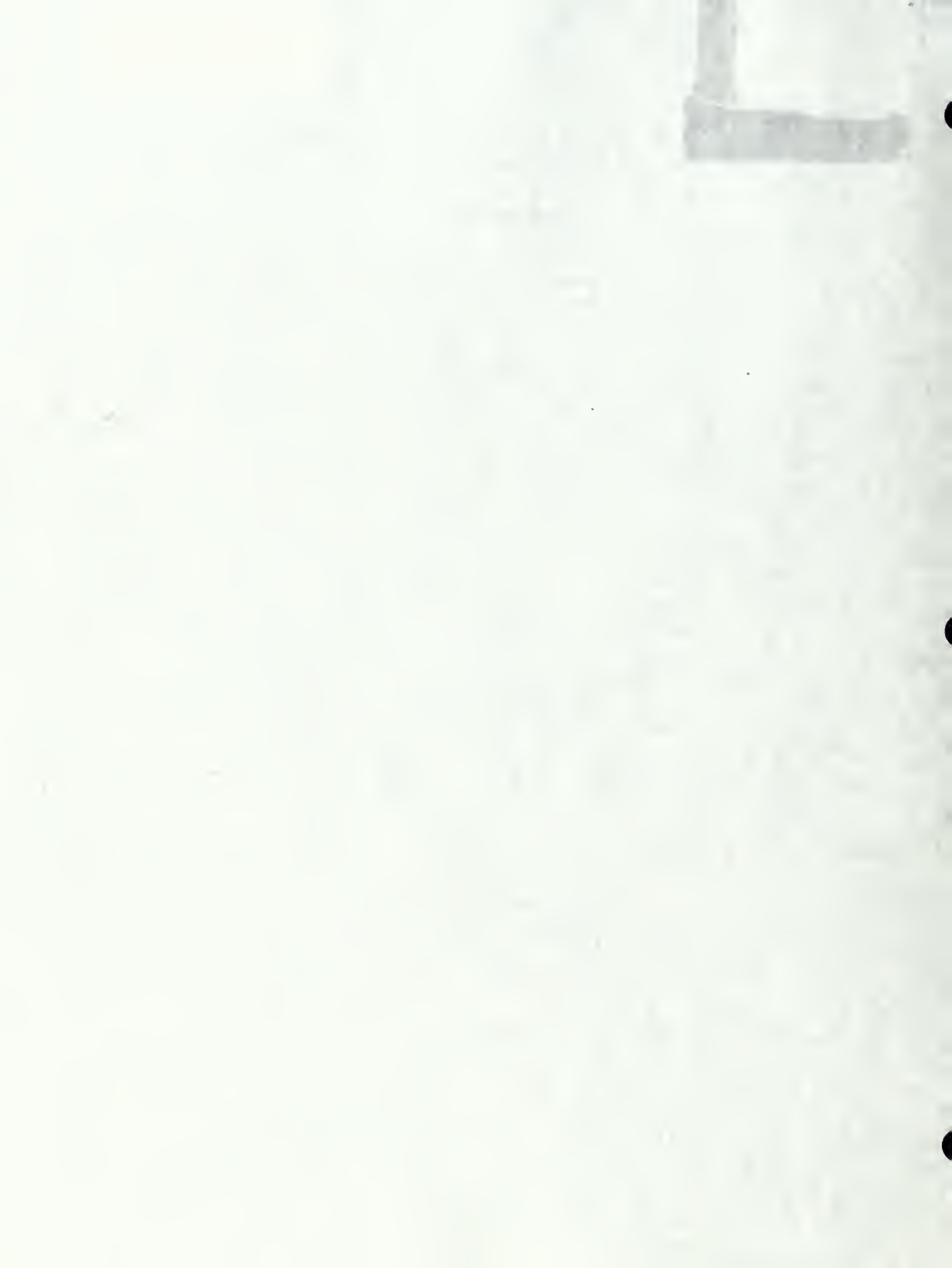
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INTRODUCTION

Aquatic invertebrates are aptly applied to bioassessment since they are known to be important indicators of stream ecosystem health (Hynes 1970). Long lives, complex life cycles and limited mobility mean that there is ample time for the benthic community to respond to cumulative effects of environmental perturbations.

This report summarizes data collected in June and July 2001 from 19 sites on ten streams in the Big Hole River watershed, Beaverhead County, Montana. Aquatic invertebrate assemblages were sampled by personnel of the Montana Department of Environmental Quality (DEQ). Study sites lie within the Northern Rocky Mountain ecoregion (Woods et al. 1999). A multimetric approach to bioassessment such as the one applied in this study uses attributes of the assemblage in an integrated way to measure biotic health. A stream with good biotic health is "... a balanced, integrated, adaptive system having the full range of elements and processes that are expected in the region's natural environment..." (Karr and Chu 1999). The approach designed by Plafkin et al. (1989) and adapted for use in the State of Montana has been defined as "... an array of measures or metrics that individually provide information on diverse biological attributes, and when integrated, provide an overall indication of biological condition." (Barbour et al. 1995). Community attributes that can contribute meaningfully to interpretation of benthic data include assemblage structure, sensitivity of community members to stress or pollution, and functional traits. Each metric component contributes an independent measure of the biotic integrity of a stream site; combining the components into a total score reduces variance and increases precision of the assessment (Fore et al. 1995). Effectiveness of the integrated metrics depends on the applicability of the underlying model, which rests on a foundation of three essential elements (Bollman 1998). The first of these is an appropriate stratification or classification of stream sites, typically, by ecoregion. Second, metrics must be selected based upon their ability to accurately express biological condition. Third, an adequate assessment of habitat conditions at each site to be studied is needed to assist in the interpretation of metric outcomes.

Implicit in the multimetric method and its associated habitat assessment is an assumption of correlative relationships between habitat parameters and the biotic metrics, in the absence of water quality impairment. These relationships may vary regionally, requiring an examination of habitat assessment elements and biotic metrics and a test of the presumed relationship between them. Bollman (1998) has recently studied the assemblages of the Montana Valleys and Foothill Prairies ecoregion, and has recommended a battery of metrics applicable to the montane ecoregions of western Montana. This metric battery has been shown to be sensitive to impairment, related to habitat assessment parameters, and consistent over replicated samples.

Habitat assessment enhances the interpretation of biological data (Barbour and Stribling 1991), because there is generally a direct response of the biological community to habitat degradation in the absence of water quality impairment. If biotic health appears more damaged than the habitat quality would predict, water pollution by metals, other toxicants, high water temperatures, or high levels of organic and/or nutrient pollution might be suspected. On the other hand, an "artificial" elevation of biotic condition in the presence of habitat degradation may be due to the paradoxical effect of mild nutrient or organic enrichment in an oligotrophic setting.

METHODS

Aquatic invertebrates were sampled by Montana DEQ personnel on June 28 and 29 and July 9-11, 2001. Nineteen sites on ten streams were sampled. Site locations and sampling dates are indicated in Table 1. The sampling method employed was that recommended in the Montana Department of Environmental Quality (DEQ) Standard Operating Procedures for Aquatic Macroinvertebrate Sampling (Bukantis 1998).

Aquatic invertebrate samples were delivered to Rhithron Biological Associates, Missoula, Montana, for laboratory and data analyses. In the laboratory, the Montana DEQ-recommended sorting method was used to obtain subsamples of at least 300 organisms from each sample, when possible. Organisms were identified to the lowest possible taxonomic levels consistent with Montana DEQ protocols.

To assess aquatic invertebrate communities in this study, a multimetric index developed in previous work for streams of western Montana ecoregions (Bollman 1998) was used. Multimetric indices result in a single numeric score, which integrates the values of several individual indicators of biologic health. Each metric used in this index was tested for its response or sensitivity to varying degrees of human influence. Correlations have been demonstrated between the metrics and various symptoms of human-caused impairment as expressed in water quality parameters or instream, streambank, and stream reach morphologic features. Metrics were screened to minimize variability over natural environmental gradients, such as site elevation or sampling season, which might confound interpretation of results (Bollman 1998). The multimetric index used in this report incorporates multiple attributes of the sampled assemblage into an integrated score that accurately describes the benthic community of each site in terms of its biologic integrity. In addition to the metrics comprising the index, other metrics, which have been shown to be applicable to biomonitoring in other regions (Kleindl 1995, Patterson 1996, Rossano 1995) were used for descriptive interpretation of results. These metrics include the number of "clinger" taxa, long-lived taxa richness, the percent of predatory organisms, and others. They are not included in the integrated bioassessment score, however, since their performance in western Montana ecoregions is unknown. However, the relationship of these metrics to habitat conditions is intuitive and reasonable.

The six metrics comprising the bioassessment index used in this study were selected because, both individually and as an integrated metric battery, they are robust at distinguishing impaired sites from relatively unimpaired sites (Bollman 1998). In addition, they are relevant to the kinds of impacts that are present in the Big Hole River drainage. They have been demonstrated to be more variable with anthropogenic disturbance than with natural environmental gradients (Bollman 1998). Each of the six metrics developed and tested for western Montana ecoregions is described below.

- 1. Ephemeroptera (mayfly) taxa richness.** The number of mayfly taxa declines as water quality diminishes. Impairments to water quality which have been demonstrated to adversely affect the ability of mayflies to flourish include elevated water temperatures, heavy metal contamination, increased turbidity, low or high pH, elevated specific conductance and toxic chemicals. Few mayfly species are able to tolerate certain disturbances to instream habitat, such as excessive sediment deposition.

Table 1. Sampling sites and dates. Nineteen sites on ten streams in the Big Hole River watershed. June-July 2001. Sites are listed from a general upstream-to-downstream sequence, relative to the Big Hole River.

Site designation	Waterbody	Sampling Date	Lat. / Long.	Site Description
J1	Joseph Creek	6/28/01	45° 40' 31"N/ 113° 52' 55"W	Near confluence with Anderson Creek
J4	Joseph Creek	6/28/01	45° 39' 43"N/ 113° 48' 55"W	Near confluence with Trail Creek
Trail1	Trail Creek	6/28/01	45° 44' 31"N/ 113° 54' 24"W	Near USFS headwaters
Trail4	Trail Creek	6/28/01	45° 42' 46"N/ 113° 52' 48"W	Hogan Cabin
Trail6	Trail Creek	6/28/01	45° 41' 49"N/ 113° 51' 22"W	Near confluence with Joseph Creek
Tie2	Tie Creek	6/29/01		Upstream Tie Creek Trailhead
Tie4	Tie Creek	6/29/01		1.5 miles from trailhead upstream
Schultz1	Schultz Creek	6/29/01	45° 46' 57"N/ 113° 46' 32"W	At road 1137 crossing near headwaters
Sv1	7-Mile Creek	7/9/01	46° 00' 14"N/ 113° 03' 17"W	Upstream road 2483 crossing
Sv3	7-Mile Creek	7/9/01	45° 59' 52"N/ 113° 03' 20"W	Downstream road 2483 crossing
C1	Corral Creek	7/10/01	45° 59' 47"N/ 113° 05' 40"W	Upstream road 2483 crossing
C4	Corral Creek	7/10/01	45° 59' 21"N/ 113° 05' 27"W	Downstream road 2483 crossing
T1	12-Mile Creek	7/10/01	45° 59' 32"N/ 113° 06' 35"W	0.5 mile upstream from road 2483 crossing
T2	12-Mile Creek	7/10/01	45° 59' 32"N/ 113° 06' 35"W	
T4	12-Mile Creek	7/10/01	45° 59' 05"N/ 113° 06' 22"W	0.5 mile downstream from road 2483 crossing
D2	Deep Creek	7/11/01	45° 56' 17"N/ 113° 05' 43"W	At road crossing on state land
Six1	6-Mile Creek	7/9/01	45° 59' 38"N/ 113° 02' 04"W	Few yards upstream of road 2483 crossing
Six2	6-Mile Creek	7/9/01		Downstream road 2483 crossing
P2	Pettengill Creek	7/11/01	45° 40' 56"N/ 113° 03' 42"W	At confluence with Wise River

2. Plecoptera (stonefly) taxa richness. Stoneflies are particularly susceptible to impairments that affect a stream on a reach-level scale, such as loss of riparian canopy, streambank instability, channelization, and alteration of morphological features such as pool frequency and function, riffle development and sinuosity. Just as all benthic organisms, they are also susceptible to smaller scale habitat loss, such as by sediment deposition, loss of interstitial spaces between substrate particles, or unstable substrate.

3. Trichoptera (caddisfly) taxa richness. Caddisfly taxa richness has been shown to decline when sediment deposition affects their habitat. In addition, the presence of certain case-building caddisflies can indicate good retention of woody debris and lack of scouring flow conditions.

4. Number of sensitive taxa. Sensitive taxa are generally the first to disappear as anthropogenic disturbances increase. The list of sensitive taxa used here includes organisms sensitive to a wide range of disturbances, including warmer water temperatures, organic or nutrient pollution, toxic pollution, sediment deposition, substrate instability, and others. Unimpaired streams of western Montana typically support at least four sensitive taxa (Bollman 1998).

5. Percent filter feeders. Filter-feeding organisms are a diverse group; they capture small particles of organic matter, or organically enriched sediment material, from the water column by means of a variety of adaptations, such as silken nets or hairy appendages. In forested montane streams, filterers are expected to occur in insignificant numbers. Their abundance increases when canopy cover is lost and when water temperatures increase and the accompanying growth of filamentous algae occurs. Some filtering organisms, specifically the Arctopsychid caddisflies (*Arctopsyche* spp. and *Parapsyche* sp.) build silken nets with large mesh sizes that capture small organisms such as chironomids and early-instar mayflies. Here they are considered predators, and, in this study, their abundance does not contribute to the percent filter feeders metric.

6. Percent tolerant taxa. Tolerant taxa are ubiquitous in stream sites, but when disturbance increases, their abundance increases proportionately. The list of taxa used here includes organisms tolerant of a wide range of disturbances, including warmer water temperatures, organic or nutrient pollution, toxic pollution, sediment deposition, substrate instability, and others.

Scoring criteria for each of the six metrics are presented in Table 2. Metrics differ in their possible value ranges as well as in the direction the values move as biological conditions change. For example, Ephemeroptera richness values may range from zero to ten taxa or higher. Larger values generally indicate favorable biotic conditions. On the other hand, the percent filterers metric may range from 0% to 100%; in this case, larger values are negative indicators of biotic health. To facilitate scoring, therefore, metric values were transformed into a single scale. The range of each metric has been divided into four parts and assigned a point score between zero and three. A score of three indicates a metric value similar to one characteristic of a non-impaired condition. A score of zero indicates strong deviation from non-impaired condition and suggests severe degradation of biotic health. Scores for each metric were summed to give an overall score, the total bioassessment score, for each site in each sampling event. These scores

Table 2. Metrics and scoring criteria for bioassessment of streams of western Montana ecoregions (Bollman 1998).

<i>metric</i>	<i>Score</i>			
	3	2	1	0
Ephemeroptera taxa richness	> 5	5 - 4	3 - 2	< 2
Plecoptera taxa richness	> 3	3 - 2	1	0
Trichoptera taxa richness	> 4	4 - 3	2	< 2
Sensitive taxa richness	> 3	3 - 2	1	0
Percent filterers	0 - 5	5.01 - 10	10.01 - 25	> 25
Percent tolerant taxa	0 - 5	5.01 - 10	10.01 - 35	> 35

were expressed as the percent of the maximum possible score, which is 18 for this metric battery.

The total bioassessment score for each site was expressed in terms of use-support. Criteria for use-support designations were developed by Montana DEQ and are presented in Table 3a. Scores were also translated into impairment classifications according to criteria outlined in Table 3a.

In this report, certain other metrics were used as descriptors of the benthic community response to habitat or water quality but were not incorporated into the bioassessment metric battery, either because they have not yet been tested for reliability in streams of western Montana, or because results of such testing did not show them to be robust at distinguishing impairment, or because they did not meet other requirements for inclusion in the metric battery. These metrics and their use in predicting the causes of impairment or in describing its effects on the biotic community are described below.

- The modified biotic index. This metric is an adaptation of the Hilsenhoff Biotic Index (HBI, Hilsenhoff 1987), which was originally designed to indicate organic enrichment of waters. Values of this metric are lowest in least impacted conditions. Taxa tolerant to saprobic conditions are also generally tolerant of warm water, fine sediment, and heavy filamentous algae growth (Bollman, unpublished data). Loss of canopy cover is often a contributor to higher biotic index values. The taxa values used in this report are modified to reflect habitat and water quality conditions in Montana (Bukantis 1998). Ordination studies of the benthic fauna of Montana's foothill prairie streams showed that there is a correlation between modified biotic index values and water temperature, substrate embeddedness, and fine sediment (Bollman 1998). In a study of reference streams, the average value of the modified biotic index in least-impaired streams of western Montana was 2.5 (Wisseman 1992).
- Taxa richness. This metric is a simple count of the number of unique taxa present in a sample. Average taxa richness in samples from reference streams in western Montana was 28 (Wisseman 1992). Taxa richness is an expression of biodiversity, and generally decreases with degraded habitat or diminished water quality. However, taxa richness may show a paradoxical increase when mild nutrient

enrichment occurs in previously oligotrophic waters, so this metric must be interpreted with caution.

- Percent predators. Aquatic invertebrate predators depend on a reliable source of invertebrate prey, and their abundance provides a measure of the trophic complexity supported by a site. Less disturbed sites have more plentiful habitat niches to support diverse prey species, which in turn support abundant predator species.
- Number of “clinger” taxa. So-called “clinger” taxa have physical adaptations that allow them to cling to smooth substrates in rapidly flowing water. Aquatic invertebrate “clingers” are sensitive to fine sediments that fill interstices between substrate particles and eliminate habitat complexity. Animals that occupy the hyporheic zones are included in this group of taxa. Expected “clinger” taxa richness in unimpaired streams of western Montana is at least 14 (Bollman, unpublished data).
- Number of long-lived taxa. Long-lived or semivoltine taxa require more than a year to completely develop, and their numbers decline when habitat and/or water quality conditions are unstable. They may completely disappear if channels are dewatered or if there are periodic water temperature elevations or other interruptions to their life cycles. Western Montana streams with stable habitat conditions are expected to support six or more long-lived taxa (Bollman, unpublished data).

Table 3a. Criteria for the assignment of use-support classifications / standards violation thresholds (Bukantis, 1997).

% Comparability to reference	Use support
>75	Full support--standards not violated
25-75	Partial support--moderate impairment--standards violated
<25	Non-support--severe impairment--standards violated

Table 3b. Criteria for the assignment of impairment classifications (Plafkin et al. 1989).

% Comparability to reference	Classification
> 83	nonimpaired
54-79	slightly impaired
21-50	moderately impaired
<17	severely impaired

RESULTS

Habitat descriptions

In lieu of the MT DEQ Habitat Assessment (MT DEQ date unknown) forms typically provided along with aquatic invertebrate samples, Riparian Assessment Worksheets (U.S. Department of Agriculture, Natural Resources Conservation Service 12/2000) and Stream Reach Assessment forms (MT DEQ date unknown) were provided. Relevant parts of these analyses are summarized here, but habitat quality was not scored.

Benthic substrate at the upper site on Joseph Creek (J 1) was described as "...large gravel, small cobbles, some boulders..." suggesting high diversity of particle sizes. Large woody debris was also reported to be present at the site, along with beds of "...ear-shaped macrophytes..." undoubtedly the blue-green alga *Nostoc* sp. Silt was essentially absent in riffles. Streambank stability was described as good with minor slumping at some crossings, but well covered by stabilizing vegetation. The riparian zone was estimated to be about 90 feet wide with a diversity of species and age classes.

Sand and gravel dominated the substrate at the downstream site on Joseph Creek (J 4), and the evaluator reported tightly packed substrate particles that were "...difficult to move..." suggesting moderate to severe embeddedness. The channel was described as naturally braided, but sediment was noted to be accumulating on edges, and point bar formation was also observed. Patches of macrophytes added diversity to habitats. While some erosion of streambanks was described on outside bends, the majority of banks appeared to be stable. A wide, thick riparian zone was documented, mostly consisting of young willows; no browsing damage was reported.

At the uppermost site on Trail Creek (Trail1), small cobbles and large gravel were reported to dominate the benthic substrate; very little silt was noted, and sand was common. Abundant woody debris added complexity to habitats. The channel was described as "...very braided..." but the site was further portrayed as a headwaters location, where marshy conditions and braiding were perhaps the normal morphological condition. Some erosion of streambanks was noted, but in general, banks were stable and well-vegetated. The marshy riparian area was estimated to be more than 90 feet wide with infrequent breaks at moose crossings. Age diversity and plant vigor were described as excellent, but some browsing effects were present.

The mid-reach site on Trail Creek (Trail4) was characterized as having some silt contamination of the benthic substrate, but substrate diversity was not further described. Like the upstream site, the channel was reported to be braided, but field personnel assessed this as appropriate for the alpine location. Streambanks were described as "...fairly stable (with) some erosion at trail crossings." Age diversity of riparian vegetation and width of the riparian zone were described as consistent with the potential of the site.

Gravel and sand dominated the benthic substrate at the downstream site on Trail Creek (Trail6); the substrate was easily dislodged, so significant embeddedness seems unlikely. Deposition of fine sediments was reported to be increasing the size of point bars, and channel braiding was noted. Some erosion was observed near a bridge crossing, but streambanks were assessed as generally stable. The adjacent highway compromised riparian zone width to some extent, but riparian vegetative diversity of species and age classes was reported to be excellent.

On Tie Creek, the upper site (Tie2) had a sandy stream bottom with some boulders; little silt was present. Gravel bars were common. Woody debris was reported to be prevalent. The moist fragile streambanks exhibited extensive erosion on outside banks, and slumping was noted as well. Only about 50% of the areal extent of streambanks was stabilized by deep-rooted plants; otherwise grasses dominated streambank vegetation. Grasses and scattered willows comprised the riparian zone, which was judged to be near potential for this site.

Cobbles, coarse gravel, coarse sand, and some boulders made up the benthic substrate at the downstream site on Tie Creek (Tie2), and instream habitat diversity was further enhanced by abundant woody debris and patches of macrophytes. Very little silt accumulation was observed. The braided channel was evaluated as appropriate for the location. Thick grasses and dense, vigorous young willows stabilized streambanks; some slumping was noted at game crossings, but vegetation was re-establishing itself in these areas. The riparian zone width was judged greater than 90 feet and at its vegetative potential.

The Schultz Creek site (Schultz1) exhibited diverse benthic substrate with cobbles, gravel, and boulders present and little to no silt apparent. No embeddedness was evident, since field personnel reported that the substrate was easily moved. Woody debris was commonly encountered instream. Minor erosion of the streambanks was confined to the access points, otherwise banks were judged stable. The riparian zone width was limited by the nearby road, and the species composition was limited to that appropriate to an alpine meadow; vegetation was mostly composed of sedges and grasses.

The substrate at the upstream site on Sevenmile Creek (Sv1) tended toward smaller particle sizes, with gravel, small cobbles, sand, and some silt described as the components. Deposition of silt was reported to be enlarging bars, but these were observed to be supporting new vegetation. The channel was described as "...naturally braided..." in this reach. Minor streambank erosion was confined to game trails, and most banks were stabilized by thick willows and shrubs. All age classes of willows were represented in the wide riparian zone; excellent species diversity and vigor was reported.

At the downstream site on Sevenmile Creek (Sv3), sand and gravel dominated the benthic substrate with a few large cobbles present. Some woody debris was available, but silt accumulations were also described as clogging the substrate. Dense vegetation stabilized streambanks; all age classes of willows dominated these areas. The riparian zone exhibited excellent plant vigor, species diversity, and age class diversity and was estimated to be more than 90 feet wide.

Abundant logs and woody debris added instream habitat diversity to the upper site on Corral Creek (C 1). The substrate was mostly composed of gravels and small cobbles. Small patches of macrophytes were also reported at the site. Little or no silt was apparent, and embeddedness was likely insignificant, since the substrate was reported to be easily moved. The channel was described as "...naturally braided." Streambank erosion was minimal, but "...horsetails and flowering plants..." were a common component of bank vegetation. Fir trees were present on streambanks as well, lending a significant degree of stability. The diversity of riparian plant species was judged to be at potential for the site, and vigor was described as good. There was apparently some monotony in the age class diversity.

The benthic substrate at the lower site on Corral Creek (C 4) was dominated by gravel and sand, and some silt was reportedly present. Abundant woody debris and large patches of macrophytes added diversity to instream habitats. Flow was described as lower than expected. Streambank erosion and instability was common throughout the reach; very little vegetation with deep binding roots was present. The riparian zone varied from 30 to 90 feet in width, but vegetation was not vigorous. Decadent willows were scattered among poplar stands.

Benthic substrate at the upstream site on Twelvemile Creek (T 1) was dominated by gravel and sand; very little silt was evident and boulders were present. The reach was described as "...naturally braided." Large patches of aquatic plant growth covered about 25% of the substrate, and woody debris was reportedly abundant. Streambanks were stable, with boulders, "...willows, young alders, numerous sedges, (and) grasses..." present. The average width of the riparian zone was estimated to be between 20 and 40 feet; an old clearcut has compromised the width. Vegetation was described as diverse, but there were few mature willows. Young willows and alders were dense along streambanks.

The site in the middle reach of Twelvemile Creek (T 2) was not evaluated or described. The downstream site (T 4) exhibited substrates composed of sand, gravel, and boulders; no significant embeddedness was noted. Very little silt was present, and the channel was described as "...naturally braided." Piles of woody debris were abundant in the channel, and macrophytes were also present. "Minor, natural bank erosion..." was present, but generally, fir trees, willows, and alders stabilized streambanks. Very dense vegetation with good species and age class diversity comprised the wide riparian zone.

Cobbles, small boulders, and gravel dominated the benthic substrate at the site on Deep Creek (D 2), but some sand was present also. Very little silt was observed. The braided channel was thought to be influenced by a great deal of beaver activity in the area. Point bars were "...common throughout the reach (and) enlarging..." with cobbles, gravel, and sand. Streambank erosion was common on outside bends, but otherwise banks were judged to be stable with thick willows and grasses vegetating the area. The riparian zone was estimated to be about 90 feet wide with browsing damage to mature willows severe.

The benthic substrate at the upstream site on Sixmile Creek (Six1) was dominated by small boulders, cobbles, and gravel, and silt deposition was evident throughout the reach. Point bars were present and moderate accumulations of silt contributed to their enlargement. Streambanks at this site were very stable, with all age classes of willows thickly vegetating them. The riparian zone was estimated to be more than 90 feet wide with excellent species diversity and vigorous growth.

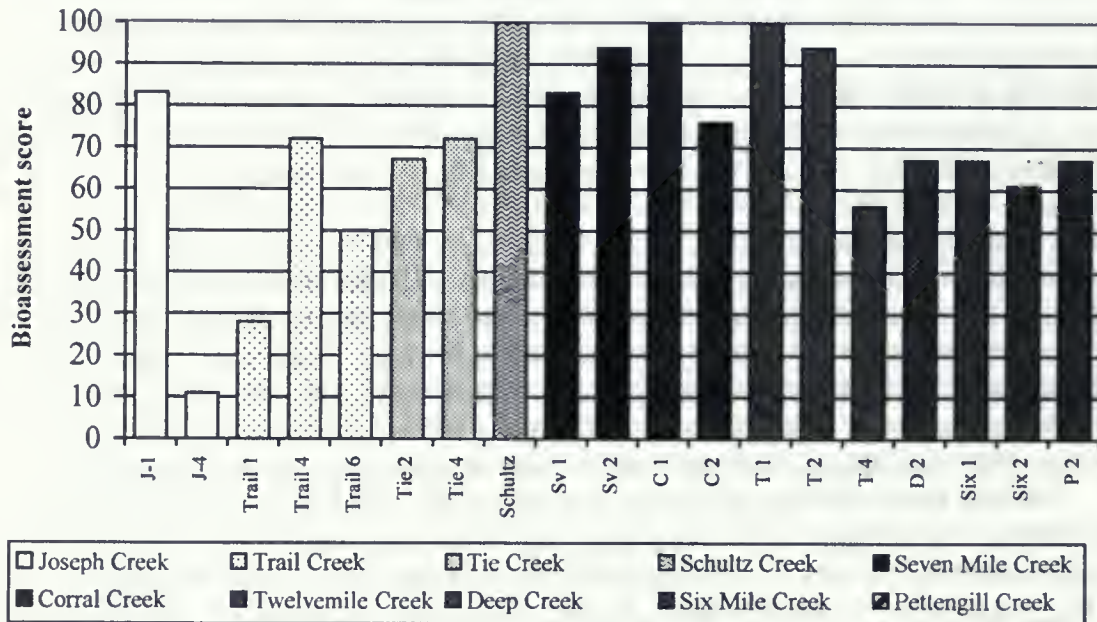
Boulders, gravel, and cobble were equally represented in the benthic substrate at the lower site on Sixmile Creek (Six2). Some silt and sand were also present. Field personnel describe the substrate as being "...deeply embedded." Some streambank erosion was noted on the very steep right bank, but all other banks were stabilized by thick willow stands; all age classes were represented. The riparian zone was wide, and vegetation was dense with plant vigor and species diversity described as excellent.

The site on Pettengill Creek (P 2) was neither described nor evaluated.

Bioassessment

Figure 1 summarizes bioassessment scores for aquatic invertebrate communities at the nineteen sites in this study. Tables 4a and 4b itemize each contributing metric and show individual metric scores for each site. Tables 3a and 3b show criteria for impairment classifications and use-support categories recommended by Montana DEQ.

Figure 1. Total bioassessment scores for nineteen sites in the Big Hole River watershed, June-July 2001. Sites are described in Table 1. In the figure, sites in the North Fork Big Hole River drainage are shaded more lightly than sites in other drainages.



Low abundance of organisms in samples complicated the evaluation of 9 of the sites in this study; conclusions and interpretation of results are tenuous for the downstream site on Joseph Creek (J 4), the downstream site on Trail Creek (Trail 6), the upstream site on Tie Creek (Tie 2), Schultz Creek, the downstream site on Corral Creek (C 4), all three sites on Twelvemile Creek (T 1, T 2, and T 4) and Pettengill Creek. Whether the inadequacy of samples was due to depauperate communities at the sites or to sampling bias is not clear from the data itself. In the case of the Twelvemile Creek sample taken at site T 4, field personnel report that excessive aquatic vegetation, combined with the fine gravel and large boulders contributed to the poor representation of organisms in the sample. Results from all of these sites should be viewed cautiously. The uncertainty of scores and classifications for these sites is noted in Tables 4a and 4b.

Eight of the nineteen sites evaluated appeared to fully support their designated uses and exhibited unimpaired biotic health, when the criteria of this method are applied. A single site, the downstream location on Joseph Creek (J 4) appeared to be severely impaired and in violation of state standards for use support. At this site, no Ephemeroptera taxa and no Plecoptera taxa were collected; in addition, no sensitive taxa were present in the sample. Only 2 Trichoptera taxa were taken. The abundance of

Table 4. Metric values, scores, and bioassessments for sites in the Big Hole River watershed, June-July 2001. Sites are described in Table 1. Assessment classifications and use support designations in parentheses are tentative, since they are based on samples with inadequate numbers of organisms.

METRICS	SITES							
	J 1	J 4	Trail 1	Trail 4	Trail 6	Tie 2	Tie 4	Schultz
	METRIC VALUES							
Ephemeroptera richness	5	0	3	8	5	5	8	6
Plecoptera richness	2	0	0	2	1	3	2	6
Trichoptera richness	5	2	2	5	1	3	1	5
Number of sensitive taxa	2	0	0	3	1	1	3	7
Percent filterers	3	11	62	27	<1	6	<1	0
Percent tolerant taxa	<1	63	2	2	6	1	2	3
METRIC SCORES								
Ephemeroptera richness	2	0	1	3	2	2	3	3
Plecoptera richness	2	0	0	2	1	2	2	3
Trichoptera richness	3	1	1	3	0	2	0	3
Number of sensitive taxa	2	0	0	2	1	1	2	3
Percent filterers	3	1	0	0	3	2	3	3
Percent tolerant taxa	3	0	3	3	2	3	3	3
TOTAL SCORE (max.=18)	15	(2)	5	13	(9)	(12)	13	(18)
PERCENT OF MAX.	83	(11)	28	72	(50)	(67)	72	(100)
Impairment classification*	NON	(SEV)	MOD	SLI	(MOD)	(SLI)	SLI	(NON)
USE SUPPORT †	FULL	(NON)	PART	PART	(PART)	(PART)	PART	(FULL)

* Classifications: (NON) non-impaired, (SLI) slightly impaired, (MOD) moderately impaired, (SEV) severely impaired. See Table 3a.
 † Use support designations: See Table 3b.

Table 4a. Metric values, scores, and bioassessments for sites in the Big Hole River watershed, June-July 2001. Sites are described in Table 1. Assessment classifications and use support designations in parentheses are tentative, since they are based on samples with inadequate numbers of organisms.

METRICS	SITES										
	Sv 1	Sv 3	C 1	C 4	T 1	T 2	T 4	D 2	Six 1	Six 2	P 2
	METRIC VALUES										
Ephemeroptera richness	8	7	7	6	9	6	7	9	7	5	4
Plecoptera richness	3	6	5	4	8	5	1	2	1	2	3
Trichoptera richness	8	6	5	1	6	4	1	8	4	4	5
Number of sensitive taxa	2	4	5	4	11	4	0	3	2	1	1
Percent filterers	1	1	0	8	<1	0	<1	14	0	0	<1
Percent tolerant taxa	10	6	5	<1	2	4	5	12	24	27	33
	METRIC SCORES										
Ephemeroptera richness	3	3	3	3	3	3	3	3	3	2	2
Plecoptera richness	2	3	3	3	3	3	1	2	1	2	2
Trichoptera richness	3	3	3	0	3	2	0	3	2	2	3
Number of sensitive taxa	2	3	3	3	3	3	0	2	2	1	1
Percent filterers	3	3	3	2	3	3	3	1	3	3	3
Percent tolerant taxa	2	2	3	3	3	3	3	1	1	1	1
TOTAL SCORE (max.=18)	15	17	18	(14)	(18)	(17)	(10)	12	12	11	(12)
PERCENT OF MAX.	83	94	100	(76)	(100)	(94)	(56)	67	67	61	(67)
Impairment classification*	NON	NON	NON	(NON)	(NON)	(NON)	(SLI)	SLI	SLI	SLI	(SLI)
USE SUPPORT †	FULL	FULL	FULL	(FULL)	(FULL)	(FULL)	(PART)	PART	PART	PART	(PART)

* Classifications: (NON) non-impaired, (SLI) slightly impaired, (MOD) moderately impaired, (SEV) severely impaired. See Table 3a.
 † Use support designations: See Table 3b.

tolerant organisms was much greater than expected, and filter-feeders were very prolific as well.

Two sites on Trail Creek (Trail 1 and Trail 6) appeared to be moderately impaired. At the upstream site, fewer Ephemeroptera and Trichoptera taxa were collected than expected for a montane stream. No Plecoptera taxa were present in the sample, nor were there any sensitive taxa. The abundance of filter-feeders was much greater than expected. At the downstream site, a single Plecoptera taxon was taken, but no Trichoptera taxa were present, and fewer Ephemeroptera taxa than expected appeared in the sample. Only a single sensitive taxon was collected.

Slight impairment was evident from scores calculated for 8 sites visited for this study.

Generally, sites in the Deep Creek drainage appeared to exhibit more balanced benthic assemblages than sites in either the North Fork Big Hole River drainage or the other two drainages represented in the study. Six of the 8 sites in the Deep Creek drainage showed signs of unimpaired biologic health, while only 2 of 8 sites in the North Fork Big Hole River drainage did so.

Aquatic invertebrate communities

At the upstream site on Joseph Creek (J 1), the benthic assemblage was dominated by the midge *Cricotopus nostococladius*, a sensitive taxon which lives in a mutualistic relationship with the blue-green algae *Nostoc* sp. This algae prefers clean water, thus, the abundance of the associated midge suggests that water quality at this site is good. The modified biotic index value (4.58) calculated for the assemblage as a whole, however, was slightly elevated, and there were somewhat fewer mayfly taxa than expected in the sample. These findings suggest that water temperature may have been somewhat elevated. Only 2 stonefly taxa were present, suggesting that reach-scale habitat may be less than ideal, perhaps because of loss of riparian canopy, channel widening, or other factors. Too few organisms were present in the sample taken at the lower site on Joseph Creek (J 4) for meaningful interpretation. If the sample results reflect actual conditions at the site, the diagnosis of severe impairment is probably accurate. Very low abundance, a preponderance of tolerant taxa, and absence of sensitive organisms suggests extremely poor water quality, extremely disturbed habitat, or both.

Evidence for water quality degradation as well as habitat disturbance can be inferred from the benthic assemblages sampled at the upstream site on Trail Creek (Trail 1). Only three mayfly taxa were collected, and no stoneflies apparently occurred at the site; these findings, plus the high modified biotic index value (6.08) suggest that water quality impairment affects biotic health. Impairment could be due to nutrient and/or organic pollution or elevated water temperature. Filter-feeders dominate the functional components of the assemblage. They comprise 62% of the sampled animals and include the midge *Tanytarsus* sp. and the blackfly *Simulium* sp. The abundance of filter-feeders suggests that suspended fine organic particulates are abundant in this reach of Trail Creek. Only 6 "clinger" taxa and only 2 caddisfly taxa were collected, suggesting that fine sediment deposition may further compromise biotic potential.

In contrast, the Trail Creek site further downstream (Trail 4) exhibits better diversity of mayfly taxa and a lower modified biotic index value (5.02), although the latter is still somewhat higher than expected for a montane system. Taxa collected at the

site include a few sensitive animals, including the midge *Heterotrissocladius* sp., the stonefly *Megarcys* sp., and the mayfly *Drunella grandis*, further suggesting that water quality impairment was not as potent an influence on the benthic assemblage as it was at the upstream site. Suspended organic particles appear to remain plentiful in this reach, however; filter-feeders comprise 27% of sampled animals. Fine sediment deposition does not seem to impact the biotic assemblage, since 17 "clinger" taxa and 5 caddisfly taxa were present.

At the most downstream site on Trail Creek (Trail 6), water temperatures appear to be warmer than expected. Two species of snails as well as leeches were collected at the site. Only a single individual of a taxon considered sensitive was collected, this was the midge *Cricotopus nostococladius*. Caddisflies were represented by a single individual of a single taxon, *Micrasema* sp., and "clinger" taxa were less abundant here than in the intermediate reach of the stream. These findings suggest that fine sediment deposition may affect the benthic assemblage to a moderate extent. The dearth of stonefly taxa may indicate reach-scale disturbances such as lack of riparian canopy, channel widening, or other factors. Organism abundance in the sample taken at this site was somewhat lower than desirable for reliable interpretation of richness metrics, however, and so hypotheses based on these metrics are suspect.

The upper site on Tie Creek (Tie 2) produced a sample with too few organisms; it is unclear whether the sample represents actual low abundance of benthos at the site, or whether sampling effort was inadequate. Nonetheless, some positive indicators are present in the data generated from the sample. For instance, no fewer than 5 mayfly taxa were present at the site, suggesting that water quality was probably not severely impaired. At least 2 shredder taxa inhabited the site, including the stonefly *Amphinemura* sp. and the caddisfly *Lepidostoma* sp.; the latter of these was present in some abundance. This suggests there were probably riparian inputs of large organic debris, and that flow conditions favored their retention.

Sample size was adequate at the downstream site on Tie Creek (Tie 4), and results suggest good water quality, since 8 mayfly taxa were present. Caddisflies were not well-represented, however, since only a single taxon was collected. This suggests that fine sediment deposition or embedded substrate particles may limit habitat diversity at this site. Although 12 "clinger" taxa were present at the site, many of these were represented by only one or two individuals.

Although sample size was smaller than desired, the assemblage taken at Schultz Creek exhibits functional balance, diversity, and sensitivity. The sampled reach of Schultz Creek appears to be the least impaired site visited in the North Fork Big Hole River drainage. The site supports no fewer than 7 sensitive taxa, including the predatory net-spinner *Parapsyche elsis*, and the cold-stenotherm *Yoraperla* sp. Six mayfly taxa suggest good water quality, and 6 stonefly taxa suggest good large-scale stream morphology. Five caddisfly taxa and 11 "clinger" taxa indicate that substrates are essentially unimpacted by fine sediment deposition. All expected functional components are amply represented in the assemblage.

Eight sites on 4 streams in the Deep Creek drainage were visited for this study; all but one of them appear to support benthic assemblages characteristic of montane stream reaches unimpacted by human disturbances. Sites on Seven Mile Creek, Corral Creek, and the upper 2 sites on Twelvemile Creek produced data that imply fully functioning

biological communities. At 3 of these sites (C 4, T 1, and T 2), sample sizes were too low to assure interpretable bioassessment results, but in most cases, richness metrics performed well enough to conclude that water and habitat quality were essentially intact. The single exception is the sample taken at the downstream site on Corral Creek (C 4), for which only one caddisfly taxon was collected. It is unclear whether this paucity of caddisfly taxa reflects actual conditions or is an artifact of sampling bias. Seven "clinger" taxa were present in this sample; these observations suggest that fine sediment deposition may diminish habitat diversity at this site.

Unlike the upstream sites, the lowermost site on Twelvemile Creek (T 4) did not produce bioassessment scores suggesting near-pristine conditions. Low abundance of organisms in the sample complicates the analysis, however. Seven mayfly taxa did occur in the sample, suggesting that water quality may have been good. Although only 155 animals were collected, 22 taxa were represented. This may indicate that diverse habitats were available at the site. None of the other generated metrics can be interpreted with confidence.

On the mainstem of Deep Creek, the single site visited supported 9 mayfly taxa, suggesting that water quality was good. This hypothesis is strengthened by the modified biotic index value (3.43), which was within expected limits. High taxa richness (35) implies that diverse niches were available in this reach. Eight caddisfly taxa were collected, and 22 "clinger" taxa, suggesting that hard substrates were not extensively obliterated by fine sediment deposition. Only 2 stonefly taxa were taken in the sample, suggesting that some morphological channel features may have been altered, such as channel widening or loss of riparian vegetation. There is some indication that water temperatures may be slightly elevated; the presence of the mayfly *Timpanoga hecuba* and the caddisflies *Helicopsyche borealis* and *Ochrotrichia* sp. support this notion, although none of these taxa appear to be particularly abundant at the site.

Water quality appears to diminish from good conditions to mildly degraded conditions from the upstream site (Six 1) to the downstream site (Six 2) on Six Mile Creek. Whereas 7 mayfly taxa were collected at the upstream site, only 5 were present in the sample taken at the lower site. Taxonomic composition of the mayfly fauna also changed dramatically between the 2 sites; at Six 1, taxa included the sensitive ephemereid *Drunella grandis* and *Ameletus* sp., which also suggests clean water. At the lower site, the tolerant baetid *Centroptilum* sp. occurs, and *Timpanoga hecuba* appears among the ephemereids. Neither site yielded many stonefly taxa, suggesting that reach-scale disturbances may exist along Six Mile Creek. The number of caddisfly taxa at both sites, as well as the number of "clinger" taxa, appears somewhat depressed; fine sediment deposition may limit available habitats.

The low abundance of organisms in the sample taken at the single Pettengill Creek site (P 2) makes conclusions tenuous. Still, the site supported at least 31 different benthic taxa, among which were 8 predatory taxa. This finding suggests good instream habitat diversity. Five caddisfly taxa were present in the sample, which might indicate that fine sediment deposition did not limit biotic potential. No other metric calculated can be reliably interpreted.

CONCLUSIONS

- In general, sites in the Deep Creek drainage appeared to have better water quality and/or less impaired habitat conditions than sites in the North Fork Big Hole River drainage or the other two drainages visited.
- Low abundance of organisms in many samples prevented reliable bioassessment of some sites. It was unclear whether the low numbers of animals was due to conditions at the stream site or to sampling procedures. Low abundance of organisms at sites could be due to natural conditions, such as torrential flow or other factors, or to anthropogenic disturbances, such as degraded water and/or habitat quality.
- Taxonomic composition of the benthic assemblage at the upper reach of Joseph Creek suggests warmer water temperatures than expected.
- Water quality impairment may limit biotic health in Trail Creek. Possible causes of impairment may be nutrient and/or organic pollution, or elevated water temperature.
- The lower site on Tie Creek may be impaired by mild-to-moderate deposition of fine sediments, which limits instream habitat quality.
- The sampled site on Schultz Creek supports an assemblage characteristic of a montane stream with minimal human disturbance.
- In the Deep Creek drainage, both sites on Seven Mile Creek and the upper site on Corral Creek support well-balanced assemblages suggesting good habitat and water quality. The lower site on Corral Creek and the two upstream sites on Twelvemile Creek also had some fairly strong indications of unimpaired biotic health, but organism abundance in the samples taken at these sites was too low for reliable interpretation of results.
- Richness metrics did not perform as well at the downstream site on Twelvemile Creek, but whether this was due to actual conditions at the site or to the low abundance of organisms in the sample taken there is unclear.
- Water quality appears to diminish from the upper site to the lower site. Impairment may be due to nutrient and/or organic pollution, or warm water temperatures, or both.
- Low sample abundance makes observations about the benthic assemblage at Pettengill Creek uncertain. However, high taxa richness, high predator taxa richness and predator abundance, and ample caddisfly taxa seem to indicate good habitat conditions at the studied site.

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APPENDIX

Taxonomic data and summaries

The Big Hole River watershed

June-July, 2001

Aquatic Invertebrate Taxonomic Data

Site Name: Joseph Creek

Site ID: J-1 6/28/01

Approx. percent of sample used: 40

Taxon	Quantity	Percent	HBI	FFG
Lumbriculidae	37	11.90	8	CG
Sphaeriidae	14	4.50	8	CG
Total Misc. Taxa	51	16.40		
<i>Baetis tricaudatus</i>	1	0.32	6	CG
<i>Ephemerella</i> sp.	6	1.93	1	CG
<i>Serratella tibialis</i>	1	0.32	2	CG
<i>Paraleptophlebia</i> sp.	3	0.96	4	CG
<i>Ameletus</i> sp.	5	1.61	0	CG
Total Ephemeroptera	16	5.14		
<i>Suwallia</i> sp.	4	1.29	0	PR
<i>Kogotus</i> sp.	2	0.64	2	PR
Total Plecoptera	6	1.93		
<i>Brachycentrus americanus</i>	3	0.96	1	OM
<i>Micrasema</i> sp.	2	0.64	1	MH
<i>Lepidostoma</i> sp.-sand case larvae	6	1.93	1	SH
Limnephilidae-early instar	2	0.64	4	UN
<i>Rhyacophila Brunnea</i> Gr.	2	0.64	1	PR
Total Trichoptera	15	4.82		
<i>Cleptelmis</i> sp.	1	0.32	4	CG
<i>Heterolimnius</i> sp.	5	1.61	4	CG
Total Coleoptera	6	1.93		
<i>Simulium</i> sp.	1	0.32	6	CF
<i>Hexatoma</i> sp.	2	0.64	2	PR
Total Diptera	3	0.96		
<i>Corynoneura</i> sp.	1	0.32	7	CG
<i>Cricotopus (Isocladius)</i> Gr.	13	4.18	7	CG
<i>Cricotopus nostococladius</i>	93	29.90	3	PH
<i>Micropsectra</i> sp.	31	9.97	7	CG
<i>Orthocladius</i> sp.	39	12.54	6	CG
<i>Pagastia</i> sp.	22	7.07	1	CG
<i>Polypedilum</i> sp.	2	0.64	6	OM
<i>Rheotanytarsus</i> sp.	8	2.57	6	CF
<i>Synorthocladius</i> sp.	2	0.64	2	CG
<i>Thienemannimyia</i> Gr.	2	0.64	6	PR
<i>Tvetenia</i> sp.	1	0.32	5	CG
Total Chironomidae	214	68.81		
Grand Total	311	100.00		

Aquatic Invertebrate Summary Data

Site Name: Joseph Creek

Site ID: J-1 6/28/01

TOTAL ABUNDANCE 311

Ephemeroptera + Plecoptera +
Trichoptera (EPT) abundance 37

TOTAL NUMBER OF TAXA 29

Number EPT taxa 12

TAXONOMIC GROUP COMPOSITION

GROUP	#TAXA	ABUNDAN	PERCENT
Misc. Taxa	2	51	16.40
Odonata	0	0	0.00
Ephemeroptera	5	16	5.14
Plecoptera	2	6	1.93
Hemiptera	0	0	0.00
Megaloptera	0	0	0.00
Trichoptera	5	15	4.82
Lepidoptera	0	0	0.00
Coleoptera	2	6	1.93
Diptera	2	3	0.96
Chironomidae	11	214	68.81

RATIOS OF TAX GROUP ABUNDANCES

EPT/Chironomidae 0.17

FUNCTIONAL FEEDING GROUP (FFG) COMPOSITION

GROUP	#TAXA	ABUNDAN	PERCENT
Predator	5	12	3.86
Parasite	0	0	0.00
Collector-gatherer	16	182	58.52
Collector-filterer	2	9	2.89
Macrophyte-herbivore	1	2	0.64
Piercer-herbivore	1	93	29.90
Scraper	0	0	0.00
Shredder	1	6	1.93
Xylophage	0	0	0.00
Omnivore	2	5	1.61
Unknown	1	2	0.64

RATIOS OF FFG ABUNDANCES

Scraper/Collector-filterer 0.00
Scraper/(Scraper + C.filterer) 0.00
Shredder/Total organisms 0.01

CONTRIBUTION OF DOMINANT TAXA

TAXON	ABUNDANCE	PERCENT
<i>Cricotopus nostococladius</i>	93	29.90
<i>Orthocladus</i> sp.	39	12.54
Lumbriculidae	37	11.90
<i>Micropsectra</i> sp.	31	9.97
<i>Pagastia</i> sp.	22	7.07
SUBTOTAL 5 DOMINANTS	222	71.38
Sphaeriidae	14	4.50
<i>Cricotopus</i> (<i>Isocladus</i>) Gr.	13	4.18
<i>Rheotanytarsus</i> sp.	8	2.57
<i>Ephemerella</i> sp.	6	1.93
<i>Lepidostoma</i> sp.	6	1.93
TOTAL DOMINANTS	269	86.50

SAPROBIC INDICES

Hilsenhoff Biotic Index 4.58

DIVERSITY MEASURES

Shannon H (loge) 2.10
Shannon H (log2) 3.03
Evenness 0.62
Simpson D 0.12

COMMUNITY VOLTINISM ANALYSIS

TYPE	ABUNDANCE	PERCENT
Multivoltine	161	51.85
Univoltine	133	42.68
Semivoltine	17	5.47

	#TAXA	ABUNDANCE	PERCENT
Tolerant	2	2	0.64
Intolerant	2	95	30.55
Clinger	12	46	14.79

Aquatic Invertebrate Taxonomic Data

Site Name: Joseph Creek

Site ID: J-4 6/28/01

Approx. percent of sample used: 100

Taxon	Quantity	Percent	HBI	FFG
<i>Oxyethira</i> sp.	1	5.26	3	PH
<i>Rhyacophila</i> -early instars or pupae	2	10.53	0	PR
Total Trichoptera	3	15.79		
<i>Optioservus</i> sp.	4	21.05	4	SC
<i>Zaitzevia</i> sp.	7	36.84	4	CG
Total Coleoptera	11	57.89		
<i>Simulium</i> sp.	2	10.53	6	CF
Total Diptera	2	10.53		
<i>Eukiefferiella</i> Gracei Gr.	2	10.53	4	OM
<i>Pagastia</i> sp.	1	5.26	1	CG
Total Chironomidae	3	15.79		
Grand Total	19	100.00		

Aquatic Invertebrate Summary Data

Site Name: Joseph Creek

Site ID: J-4 6/28/01

TOTAL ABUNDANCE 19
 Ephemeroptera + Plecoptera +
 Trichoptera (EPT) abundance 3

TOTAL NUMBER OF TAXA 7
 Number EPT taxa 2

TAXONOMIC GROUP COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Misc. Taxa	0	0	0.00
Odonata	0	0	0.00
Ephemeroptera	0	0	0.00
Plecoptera	0	0	0.00
Hemiptera	0	0	0.00
Megaloptera	0	0	0.00
Trichoptera	2	3	15.79
Lepidoptera	0	0	0.00
Coleoptera	2	11	57.89
Diptera	1	2	10.53
Chironomidae	2	3	15.79

RATIOS OF TAX GROUP ABUNDANCES

EPT/Chironomidae 1.00

FUNCTIONAL FEEDING GROUP (FFG) COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Predator	1	2	10.53
Parasite	0	0	0.00
Collector-gatherer	2	8	42.11
Collector-filterer	1	2	10.53
Macrophyte-herbivore	0	0	0.00
Piercer-herbivore	1	1	5.26
Scraper	1	4	21.05
Shredder	0	0	0.00
Xylophage	0	0	0.00
Omnivore	1	2	10.53
Unknown	0	0	0.00

RATIOS OF FFG ABUNDANCES

Scraper/Collector-filterer 2.00
 Scraper/(Scraper + C.filterer) 0.67
 Shredder/Total organisms 0.00

CONTRIBUTION OF DOMINANT TAXA

TAXON	ABUNDANCE	PERCENT
<i>Zaitzevia</i> sp.	7	36.84
<i>Optioservus</i> sp.	4	21.05
Rhyacophila-early instars or pup	2	10.53
<i>Simulium</i> sp.	2	10.53
Eukiefferiella Gracei Gr.	2	10.53
SUBTOTAL 5 DOMINANTS	17	89.47
<i>Oxyethira</i> sp.	1	5.26
<i>Pagastia</i> sp.	1	5.26

TOTAL DOMINANTS 19 100.00

SAPROBIC INDICES

Hilsenhoff Biotic Index 3.58

DIVERSITY MEASURES

Shannon H (loge) 1.72
 Shannon H (log2) 2.48
 Evenness 0.88
 Simpson D #DIV/0!

COMMUNITY VOLTINISM ANALYSIS

TYPE	ABUNDANCE	PERCENT
Multivoltine	3	15.79
Univoltine	4	21.05
Semivoltine	12	63.16

	#TAXA	ABUNDANCE	PERCENT
Tolerant	3	12	63.16
Intolerant	0	0	0.00
Clinger	5	16	84.21

Aquatic Invertebrate Taxonomic Data

Site Name: Trail Creek

Site ID: T-1 6/28/01

Approx. percent of sample used: 17

Taxon	Quantity	Percent	HBI	FFG
Tubificidae - immature	3	0.96	9	CG
<i>Eiseniella tetraedra</i>	1	0.32	8	CG
Sphaeriidae	13	4.14	8	CG
Total Misc. Taxa	17	5.41		
<i>Diphetor hageni</i>	8	2.55	5	CG
<i>Serratella tibialis</i>	11	3.50	2	CG
<i>Ameletus</i> sp.	1	0.32	0	CG
Total Ephemeroptera	20	6.37		
<i>Sialis</i> sp.	1	0.32	4	PR
Total Megaloptera	1	0.32		
<i>Lepidostoma</i> sp.-sand case larvae	3	0.96	1	SH
<i>Rhyacophila Brunnea</i> Gr.	1	0.32	1	PR
Total Trichoptera	4	1.27		
Dytiscidae	1	0.32	5	PR
<i>Cleptelmis</i> sp.	2	0.64	4	CG
Total Coleoptera	3	0.96		
<i>Simulium</i> sp.	41	13.06	6	CF
Tabanidae	1	0.32	8	PR
Total Diptera	42	13.38		
<i>Ablabesmyia</i> sp.	1	0.32	8	CG
<i>Cricotopus (Isocladius)</i> Gr.	65	20.70	7	CG
<i>Eukiefferiella Gracei</i> Gr.	1	0.32	4	OM
<i>Rheocricotopus</i> sp.	1	0.32	6	OM
<i>Tanytarsus</i> sp.	155	49.36	6	CF
<i>Thienemannimyia</i> Gr.	1	0.32	6	PR
<i>Zavrelimyia</i> sp.	3	0.96	8	PR
Total Chironomidae	227	72.29		
Grand Total	314	100.00		

Aquatic Invertebrate Summary Data

Site Name: Trail Creek

Site ID: T-1 6/28/01

TOTAL ABUNDANCE 314
 Ephemeroptera + Plecoptera +
 Trichoptera (EPT) abundance 24

TOTAL NUMBER OF TAXA 20
 Number EPT taxa 5

TAXONOMIC GROUP COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Misc. Taxa	3	17	5.41
Odonata	0	0	0.00
Ephemeroptera	3	20	6.37
Plecoptera	0	0	0.00
Hemiptera	0	0	0.00
Megaloptera	1	1	0.32
Trichoptera	2	4	1.27
Lepidoptera	0	0	0.00
Coleoptera	2	3	0.96
Diptera	2	42	13.38
Chironomidae	7	227	72.29

RATIOS OF TAX GROUP ABUNDANCES

EPT/Chironomidae 0.11

FUNCTIONAL FEEDING GROUP (FFG) COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Predator	6	8	2.55
Parasite	0	0	0.00
Collector-gatherer	9	105	33.44
Collector-filterer	2	196	62.42
Macrophyte-herbivore	0	0	0.00
Piercer-herbivore	0	0	0.00
Scraper	0	0	0.00
Shredder	1	3	0.96
Xylophage	0	0	0.00
Omnivore	2	2	0.64
Unknown	0	0	0.00

RATIOS OF FFG ABUNDANCES

Scraper/Collector-filterer 0.00
 Scraper/(Scraper + C.filterer) 0.00
 Shredder/Total organisms 0.00

CONTRIBUTION OF DOMINANT TAXA

TAXON	ABUNDANCE	PERCENT
<i>Tanytarsus</i> sp.	155	49.36
<i>Cricotopus</i> (<i>Isocladius</i>) Gr.	65	20.70
<i>Simulium</i> sp.	41	13.06
Sphaeriidae	13	4.14
<i>Serratella tibialis</i>	11	3.50
SUBTOTAL 5 DOMINANTS	285	90.76
<i>Dipheter</i> <i>hageni</i>	8	2.55
Tubificidae - immature	3	0.96
<i>Lepidostoma</i> sp.-sand case larv.	3	0.96
<i>Zavrelimyia</i> sp.	3	0.96
<i>Cleptelmis</i> sp.	2	0.64
TOTAL DOMINANTS	304	96.82

SAPROBIC INDICES

Hilsenhoff Biotic Index 6.08

DIVERSITY MEASURES

Shannon H (log_e) 1.27
 Shannon H (log₂) 1.84
 Evenness 0.42
 Simpson D 0.25

COMMUNITY VOLUNTINISM ANALYSIS

TYPE	ABUNDANCE	PERCENT
Multivoltine	176	56.13
Univoltine	128	40.68
Semivoltine	10	3.18

	#TAXA	ABUNDANCE	PERCENT
Tolerant	4	7	2.23
Intolerant	0	0	0.00
Clinger	6	275	87.58

Aquatic Invertebrate Taxonomic Data

Site Name: Trail Creek

Site ID: T-4 6/28/01

Approx. percent of sample used: 13

Taxon	Quantity	Percent	HBI	FFG
Tubificidae - immature	2	0.66	9	CG
Sphaeriidae	71	23.28	8	CG
Physidae	1	0.33	8	CG
Total Misc. Taxa	74	24.26		
<i>Acentrella insignificans</i>	4	1.31	4	CG
<i>Baetis tricaudatus</i>	4	1.31	6	CG
<i>Dipheter hageni</i>	9	2.95	5	CG
<i>Drunella grandis</i>	3	0.98	2	CG
<i>Ephemerella inermis</i>	2	0.66	1	CG
<i>Serratella tibialis</i>	3	0.98	2	CG
<i>Cinygmula</i> sp.	1	0.33	4	SC
<i>Ameletus</i> sp.	1	0.33	0	CG
Total Ephemeroptera	27	8.85		
<i>Suwallia</i> sp.	2	0.66	0	PR
<i>Megarcys</i> sp.	7	2.30	2	PR
Total Plecoptera	9	2.95		
<i>Brachycentrus americanus</i>	31	10.16	1	OM
<i>Micrasema</i> sp.	1	0.33	1	MH
<i>Lepidostoma</i> sp.-turret case larvae	4	1.31	2	SH
Rhyacophila-early instars or pupae	1	0.33	0	PR
<i>Neophylax splendens</i>	5	1.64	2	SC
Total Trichoptera	42	13.77		
<i>Optioservus</i> sp.	1	0.33	4	SC
Total Coleoptera	1	0.33		
<i>Atherix</i> sp.	4	1.31	4	PR
Ceratopogoninae	1	0.33	6	PR
<i>Clinocera</i> sp.	4	1.31	6	PR
<i>Simulium</i> sp.	2	0.66	6	CF
<i>Antocha</i> sp.	7	2.30	3	CG
<i>Hexatoma</i> sp.	8	2.62	2	PR
Total Diptera	26	8.52		
<i>Cricotopus</i> (<i>Isocladius</i>) Gr.	6	1.97	7	CG
<i>Cricotopus nostococladius</i>	3	0.98	3	PH
<i>Eukiefferiella Brehmi</i> Gr.	5	1.64	4	OM
<i>Heterotrissocladius</i> sp.	7	2.30	0	CG
<i>Microtendipes</i> sp.	12	3.93	6	CG
<i>Pagastia</i> sp.	6	1.97	1	CG
<i>Polypedilum</i> sp.	4	1.31	6	OM
<i>Rheotanytarsus</i> sp.	5	1.64	6	CF
<i>Tanytarsus</i> sp.	75	24.59	6	CF
<i>Thienemannimyia</i> Gr.	3	0.98	6	PR
Total Chironomidae	126	41.31		
Grand Total	305	100.00		

Aquatic Invertebrate Summary Data

Site Name: Trail Creek

Site ID: T-4 6/28/01

TOTAL ABUNDANCE 305

Ephemeroptera + Plecoptera +
Trichoptera (EPT) abundance 78

TOTAL NUMBER OF TAXA 35

Number EPT taxa 15

TAXONOMIC GROUP COMPOSITION

GROUP	#TAXA	ABUNDAN	PERCENT
Misc. Taxa	3	74	24.26
Odonata	0	0	0.00
Ephemeroptera	8	27	8.85
Plecoptera	2	9	2.95
Hemiptera	0	0	0.00
Megaloptera	0	0	0.00
Trichoptera	5	42	13.77
Lepidoptera	0	0	0.00
Coleoptera	1	1	0.33
Diptera	6	26	8.52
Chironomidae	10	126	41.31

RATIOS OF TAX GROUP ABUNDANCES

EPT/Chironomidae 0.62

FUNCTIONAL FEEDING GROUP (FFG) COMPOSITION

GROUP	#TAXA	ABUNDAN	PERCENT
Predator	8	30	9.84
Parasite	0	0	0.00
Collector-gatherer	15	138	45.25
Collector-filterer	3	82	26.89
Macrophyte-herbivore	1	1	0.33
Piercer-herbivore	1	3	0.98
Scraper	3	7	2.30
Shredder	1	4	1.31
Xylophage	0	0	0.00
Omnivore	3	40	13.11
Unknown	0	0	0.00

RATIOS OF FFG ABUNDANCES

Scraper/Collector-filterer 0.09
Scraper/(Scraper + C.filterer) 0.08
Shredder/Total organisms 0.00

CONTRIBUTION OF DOMINANT TAXA

TAXON	ABUNDANCE	PERCENT
<i>Tanytarsus</i> sp.	75	24.59
Sphaeriidae	71	23.28
<i>Brachycentrus americanus</i>	31	10.16
<i>Microtendipes</i> sp.	12	3.93
<i>Diphotor hageni</i>	9	2.95
SUBTOTAL 5 DOMINANTS	198	64.92
<i>Hexatoma</i> sp.	8	2.62
<i>Megarcys</i> sp.	7	2.30
<i>Antocha</i> sp.	7	2.30
<i>Heterotrissocladius</i> sp.	7	2.30
Cricotopus (Isocladius) Gr.	6	1.97
TOTAL DOMINANTS	233	76.39

SAPROBIC INDICES

Hilsenhoff Biotic Index 5.02

DIVERSITY MEASURES

Shannon H (loge) 2.29
Shannon H (log2) 3.30
Evenness 0.64
Simpson D 0.11

COMMUNITY VOLTINISM ANALYSIS

TYPE	ABUNDANCE	PERCENT
Multivoltine	107	35.16
Univoltine	130	42.54
Semivoltine	68	22.30

	#TAXA	ABUNDANCE	PERCENT
Tolerant	3	6	1.97
Intolerant	3	17	5.57
Clinger	17	158	51.80

Aquatic Invertebrate Taxonomic Data

Site Name: Trail Creek

Site ID: T-6 6/28/01

Approx. percent of sample used: 100

Taxon	Quantity	Percent	HBI	FFG
<i>Polycelis coronata</i>	2	0.87	4	CG
<i>Eiseniella tetraedra</i>	9	3.90	8	CG
<i>Helobdella</i>	2	0.87	6	PR
Sphaeriidae	46	19.91	8	CG
<i>Fossaria</i> sp.	1	0.43	6	CG
<i>Gyraulus</i> sp.	5	2.16	8	SC
Acari	1	0.43	5	PA
Total Misc. Taxa	66	28.57		
<i>Acentrella insignificans</i>	6	2.60	4	CG
<i>Diphetero hageni</i>	5	2.16	5	CG
<i>Cinygmula</i> sp.	3	1.30	4	SC
<i>Paraleptophlebia temporalis</i>	1	0.43	4	CG
<i>Ameletus</i> sp.	2	0.87	0	CG
Total Ephemeroptera	17	7.36		
<i>Suwallia</i> sp.	8	3.46	0	PR
Total Plecoptera	8	3.46		
<i>Micrasema</i> sp.	1	0.43	1	MH
Total Trichoptera	1	0.43		
Elmidae - early instars	2	0.87	4	CG
<i>Cleptelmis</i> sp.	4	1.73	4	CG
<i>Lara avara</i>	1	0.43	4	SH
<i>Optioservus</i> sp.	1	0.43	4	SC
<i>Zaitzevia</i> sp.	2	0.87	4	CG
<i>Brychius</i> sp.	1	0.43	5	MH
Total Coleoptera	11	4.76		
<i>Chelifera</i> sp.	1	0.43	6	PR
<i>Simulium</i> sp.	1	0.43	6	CF
Total Diptera	2	0.87		
<i>Cricotopus Bicinctus</i> Gr.	25	10.82	7	CG
<i>Cricotopus (Isocladius)</i> Gr.	2	0.87	7	CG
<i>Cricotopus nostococladus</i>	1	0.43	3	PH
<i>Eukiefferiella Brehmi</i> Gr.	27	11.69	4	OM
<i>Eukiefferiella Devonica</i> Gr.	4	1.73	4	OM
<i>Micropsectra</i> sp.	52	22.51	7	CG
<i>Microtendipes</i> sp.	2	0.87	6	CG
<i>Pagastia</i> sp.	2	0.87	1	CG
<i>Parachironomus</i> sp.	1	0.43	10	PR
<i>Parametrioctenus</i> sp.	3	1.30	5	CG
<i>Synorthocladius</i> sp.	1	0.43	2	CG
<i>Thienemanniella</i> sp.	2	0.87	6	CG
<i>Thienemannimyia</i> Gr.	4	1.73	6	PR
Total Chironomidae	126	54.55		
Grand Total	231	100.00		

Aquatic Invertebrate Summary Data

Site Name: Trail Creek

Site ID: T-6 6/28/01

TOTAL ABUNDANCE 231
 Ephemeroptera + Plecoptera +
 Trichoptera (EPT) abundance 26

TOTAL NUMBER OF TAXA 35
 Number EPT taxa 7

TAXONOMIC GROUP COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Misc. Taxa	7	66	28.57
Odonata	0	0	0.00
Ephemeroptera	5	17	7.36
Plecoptera	1	8	3.46
Hemiptera	0	0	0.00
Megaloptera	0	0	0.00
Trichoptera	1	1	0.43
Lepidoptera	0	0	0.00
Coleoptera	6	11	4.76
Diptera	2	2	0.87
Chironomidae	13	126	54.55

RATIOS OF TAX GROUP ABUNDANCES

EPT/Chironomidae 0.21

FUNCTIONAL FEEDING GROUP (FFG) COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Predator	5	16	6.93
Parasite	1	1	0.43
Collector-gatherer	19	169	73.16
Collector-filterer	1	1	0.43
Macrophyte-herbivore	2	2	0.87
Piercer-herbivore	1	1	0.43
Scraper	3	9	3.90
Shredder	1	1	0.43
Xylophage	0	0	0.00
Omnivore	2	31	13.42
Unknown	0	0	0.00

RATIOS OF FFG ABUNDANCES

Scraper/Collector-filterer 9.00
 Scraper/(Scraper + C.filterer) 0.90
 Shredder/Total organisms 0.00

CONTRIBUTION OF DOMINANT TAXA

TAXON	ABUNDANCE	PERCENT
<i>Micropsectra</i> sp.	52	22.51
Sphaeriidae	46	19.91
Eukiefferiella Brehmi Gr.	27	11.69
Cricotopus Bicinctus Gr.	25	10.82
<i>Eiseniella tetraedra</i>	9	3.90
SUBTOTAL 5 DOMINANTS	159	68.83
<i>Suwallia</i> sp.	8	3.46
<i>Acentrella insignificans</i>	6	2.60
<i>Gyraulus</i> sp.	5	2.16
<i>Dipheter hageni</i>	5	2.16
<i>Cleptelmis</i> sp.	4	1.73
TOTAL DOMINANTS	187	80.95

SAPROBIC INDICES

Hilsenhoff Biotic Index 6.02

DIVERSITY MEASURES

Shannon H (log_e) 2.27
 Shannon H (log₂) 3.27
 Evenness 0.64
 Simpson D 0.11

COMMUNITY VOLTINISM ANALYSIS

TYPE	ABUNDANCE	PERCENT
Multivoltine	106	45.78
Univoltine	91	39.50
Semivoltine	34	14.72

	#TAXA	ABUNDANCE	PERCENT
Tolerant	7	15	6.49
Intolerant	1	1	0.43
Clinger	10	42	18.18

Aquatic Invertebrate Taxonomic Data

Site Name: Tie Creek

Site ID: Tie-2 6/29/01

Approx. percent of sample used: 100

Taxon	Quantity	Percent	HBI	FFG
Acari	3	3.49	5	PA
Total Misc. Taxa	3	3.49		
<i>Ephemerella inermis</i>	2	2.33	1	CG
<i>Serratella tibialis</i>	1	1.16	2	CG
<i>Cinygmula</i> sp.	1	1.16	4	SC
<i>Epeorus longimanus</i>	1	1.16	1	SC
<i>Ameletus</i> sp.	1	1.16	0	CG
Total Ephemeroptera	6	6.98		
<i>Sweltsa</i> sp.	3	3.49	1	PR
<i>Amphinemura</i> sp.	1	1.16	2	SH
<i>Kogotus</i> sp.	1	1.16	2	PR
Total Plecoptera	5	5.81		
<i>Sialis</i> sp.	2	2.33	4	PR
Total Megaloptera	2	2.33		
<i>Lepidostoma</i> sp.-turret case larvae	12	13.95	2	SH
Limnephilidae - early instars	7	8.14	4	UN
<i>Polycentropus</i> sp.	1	1.16	6	PR
Total Trichoptera	20	23.26		
<i>Cleptelmis addenda</i>	1	1.16	4	CG
Total Coleoptera	1	1.16		
<i>Prosimulium</i> sp.	1	1.16	3	CF
<i>Simulium</i> sp.	4	4.65	6	CF
<i>Tipula</i> sp.	1	1.16	4	OM
Total Diptera	6	6.98		
<i>Cricotopus Bicinctus</i> Gr.	7	8.14	7	CG
<i>Eukiefferiella Devonica</i> Gr.	2	2.33	4	OM
<i>Micropsectra</i> sp.	33	38.37	7	CG
<i>Radotanypus</i> sp.	1	1.16	4	PR
Total Chironomidae	43	50.00		
Grand Total	86	100.00		

Aquatic Invertebrate Summary Data

Site Name: Tie Creek

Site ID: Tie-2 6/29/01

TOTAL ABUNDANCE 86

Ephemeroptera + Plecoptera +
Trichoptera (EPT) abundance 31

TOTAL NUMBER OF TAXA 21

Number EPT taxa 11

TAXONOMIC GROUP COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Misc. Taxa	1	3	3.49
Odonata	0	0	0.00
Ephemeroptera	5	6	6.98
Plecoptera	3	5	5.81
Hemiptera	0	0	0.00
Megaloptera	1	2	2.33
Trichoptera	3	20	23.26
Lepidoptera	0	0	0.00
Coleoptera	1	1	1.16
Diptera	3	6	6.98
Chironomidae	4	43	50.00

RATIOS OF TAX GROUP ABUNDANCES

EPT/Chironomidae 0.72

FUNCTIONAL FEEDING GROUP (FFG) COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Predator	5	8	9.30
Parasite	1	3	3.49
Collector-gatherer	6	45	52.33
Collector-filterer	2	5	5.81
Macrophyte-herbivore	0	0	0.00
Piercer-herbivore	0	0	0.00
Scraper	2	2	2.33
Shredder	2	13	15.12
Xylophage	0	0	0.00
Omnivore	2	3	3.49
Unknown	1	7	8.14

RATIOS OF FFG ABUNDANCES

Scraper/Collector-filterer 0.40
Scraper/(Scraper + C.filterer) 0.29
Shredder/Total organisms 0.18

CONTRIBUTION OF DOMINANT TAXA

TAXON	ABUNDANCE	PERCENT
<i>Micropsectra</i> sp.	33	38.37
<i>Lepidostoma</i> sp.-turret case lar	12	13.95
Limnephilidae - early instars	7	8.14
Cricotopus Bicinctus Gr.	7	8.14
<i>Simulium</i> sp.	4	4.65
SUBTOTAL 5 DOMINANTS	63	73.26
Acari	3	3.49
<i>Sweltsa</i> sp.	3	3.49
<i>Ephemerella inermis</i>	2	2.33
<i>Sialis</i> sp.	2	2.33

TOTAL DOMINANTS 73 84.88

SAPROBIC INDICES

Hilsenhoff Biotic Index 4.93

DIVERSITY MEASURES

Shannon H (loge)	1.90
Shannon H (log2)	2.74
Evenness	0.62
Simpson D	0.18

COMMUNITY VOLTINISM ANALYSIS

TYPE	ABUNDANCE	PERCENT
Multivoltine	36	41.57
Univoltine	49	57.27
Semivoltine	1	1.16

	#TAXA	ABUNDANCE	PERCENT
Tolerant	1	1	1.16
Intolerant	1	1	1.16
Clinger	10	20	23.26

Aquatic Invertebrate Taxonomic Data

Site Name: Tie Creek

Site ID: Tie-4 6/29/01

Approx. percent of sample used: 17

Taxon	Quantity	Percent	HBI	FFG
Nematoda	1	0.32	5	PA
Enchytraeidae	6	1.95	4	CG
Sphaeriidae	1	0.32	8	CG
Acari	3	0.97	5	PA
Total Misc. Taxa	11	3.57		
<i>Baetis tricaudatus</i>	1	0.32	6	CG
<i>Dipheter hageni</i>	2	0.65	5	CG
<i>Drunella spinifera</i>	3	0.97	0	PR
<i>Ephemerella inermis</i>	6	1.95	1	CG
<i>Serratella tibialis</i>	9	2.92	2	CG
<i>Cinygmula</i> sp.	2	0.65	4	SC
<i>Epeorus longimanus</i>	3	0.97	1	SC
<i>Ameletus</i> sp.	2	0.65	0	CG
Total Ephemeroptera	28	9.09		
Chloroperlidae - early instars	13	4.22	1	PR
Zapada Oregonensis Gr.	1	0.32	2	SH
Total Plecoptera	14	4.55		
<i>Rhyacophila narvae</i>	7	2.27	1	PR
Total Trichoptera	7	2.27		
<i>Cleptelmis addenda</i>	2	0.65	4	CG
<i>Heterlimnius</i> sp.	6	1.95	4	CG
<i>Optioservus</i> sp.	1	0.32	4	SC
Total Coleoptera	9	2.92		
Ceratopogoninae	10	3.25	6	PR
<i>Oreogeton</i> sp.	1	0.32	6	PR
<i>Simulium</i> sp.	3	0.97	6	CF
<i>Antocha</i> sp.	1	0.32	3	CG
<i>Hexatoma</i> sp.	1	0.32	2	PR
<i>Limnophila</i> sp.	1	0.32	6	MH
<i>Rhabdomastix</i> sp.	1	0.32	3	UN
<i>Tipula</i> sp.	2	0.65	4	OM
Total Diptera	20	6.49		
<i>Cricotopus</i> sp.	62	20.13	7	CG
<i>Cricotopus nostococladus</i>	15	4.87	3	PH
Eukiefferiella Brehmi Gr.	3	0.97	4	OM
Eukiefferiella Devonica Gr.	15	4.87	4	OM
<i>Micropsectra</i> sp.	90	29.22	7	CG
<i>Pagastia</i> sp.	11	3.57	1	CG
<i>Thienemanniella</i> sp.	19	6.17	6	CG
Thienemannimyia Gr.	4	1.30	6	PR
Total Chironomidae	219	71.10		
Grand Total	308	100.00		

Aquatic Invertebrate Summary Data

Site Name: Tie Creek

Site ID: Tie-4 6/29/01

TOTAL ABUNDANCE 308
 Ephemeroptera + Plecoptera +
 Trichoptera (EPT) abundance 49

TOTAL NUMBER OF TAXA 34
 Number EPT taxa 11

TAXONOMIC GROUP COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Misc. Taxa	4	11	3.57
Odonata	0	0	0.00
Ephemeroptera	8	28	9.09
Plecoptera	2	14	4.55
Hemiptera	0	0	0.00
Megaloptera	0	0	0.00
Trichoptera	1	7	2.27
Lepidoptera	0	0	0.00
Coleoptera	3	9	2.92
Diptera	8	20	6.49
Chironomidae	8	219	71.10

RATIOS OF TAX GROUP ABUNDANCES

EPT/Chironomidae 0.22

FUNCTIONAL FEEDING GROUP (FFG) COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Predator	7	39	12.66
Parasite	2	4	1.30
Collector-gatherer	14	218	70.78
Collector-filterer	1	3	0.97
Macrophyte-herbivore	1	1	0.32
Piercer-herbivore	1	15	4.87
Scraper	3	6	1.95
Shredder	1	1	0.32
Xylophage	0	0	0.00
Omnivore	3	20	6.49
Unknown	1	1	0.32

RATIOS OF FFG ABUNDANCES

Scraper/Collector-filterer 2.00
 Scraper/(Scraper + C.filterer) 0.67
 Shredder/Total organisms 0.00

CONTRIBUTION OF DOMINANT TAXA

TAXON	ABUNDANCE	PERCENT
<i>Micropsectra</i> sp.	90	29.22
<i>Cricotopus</i> sp.	62	20.13
<i>Thienemanniella</i> sp.	19	6.17
<i>Cricotopus nostococladus</i>	15	4.87
<i>Eukiefferiella Devonica</i> Gr.	15	4.87
SUBTOTAL 5 DOMINANTS	201	65.26
Chloroperlidae - early instars	13	4.22
<i>Pagastia</i> sp.	11	3.57
Ceratopogoninae	10	3.25
<i>Serratella tibialis</i>	9	2.92
<i>Rhyacophila narvae</i>	7	2.27
TOTAL DOMINANTS	251	81.49

SAPROBIC INDICES

Hilsenhoff Biotic Index 5.19

DIVERSITY MEASURES

Shannon H (loge) 2.20
 Shannon H (log2) 3.18
 Evenness 0.63
 Simpson D 0.12

COMMUNITY VOLTINISM ANALYSIS

TYPE	ABUNDANCE	PERCENT
Multivoltine	171	55.36
Univoltine	125	40.42
Semivoltine	13	4.22

	#TAXA	ABUNDANCE	PERCENT
Tolerant	4	5	1.62
Intolerant	3	17	5.52
Clinger	12	105	34.09

Aquatic Invertebrate Taxonomic Data

Site Name: Schultz Creek

Site ID: S-1 6/29/01

Approx. percent of sample used: 100

Taxon	Quantity	Percent	HBI	FFG
<i>Polycelis coronata</i>	4	1.69	4	CG
Tubificidae - immature	3	1.27	9	CG
<i>Eiseniella tetraedra</i>	2	0.85	8	CG
Total Misc. Taxa	9	3.81		
<i>Baetis tricaudatus</i>	7	2.97	6	CG
<i>Drunella coloradensis</i>	5	2.12	0	CG
<i>Drunella doddsi</i>	6	2.54	0	CG
<i>Cinygma</i> sp.	1	0.42	2	SC
<i>Cinygmula</i> sp.	47	19.92	4	SC
<i>Ameletus</i> sp.	2	0.85	0	CG
Total Ephemeroptera	68	28.81		
<i>Sweltsa</i> sp.	2	0.85	1	PR
Leuctridae-early instar	1	0.42	0	SH
<i>Visoka cataractae</i>	12	5.08	0	SH
<i>Doroneuria</i> sp.	6	2.54	1	PR
<i>Megarcys</i> sp.	4	1.69	2	PR
<i>Yoraperla</i> sp.	22	9.32	1	SH
Total Plecoptera	47	19.92		
<i>Parapsyche elsis</i>	4	1.69	1	PR
<i>Rhyacophila Brunnea</i> Gr.	1	0.42	1	PR
<i>Rhyacophila narvae</i>	6	2.54	1	PR
<i>Rhyacophila pellisa</i>	1	0.42	1	PR
<i>Neothremma</i> sp.	3	1.27	0	SC
Total Trichoptera	15	6.36		
<i>Heterlimnius</i> sp.	7	2.97	4	CG
Total Coleoptera	7	2.97		
<i>Hexatoma</i> sp.	4	1.69	2	PR
Total Diptera	4	1.69		
<i>Brillia</i> sp.	7	2.97	5	SH
<i>Corynoneura</i> sp.	1	0.42	7	CG
<i>Eukiefferiella Brehmi</i> Gr.	9	3.81	4	OM
<i>Micropsectra</i> sp.	62	26.27	7	CG
<i>Pagastia</i> sp.	1	0.42	1	CG
<i>Parametriocnemus</i> sp.	2	0.85	5	CG
<i>Thienemanniella</i> sp.	3	1.27	6	CG
<i>Tvetenia</i> sp.	1	0.42	5	CG
Total Chironomidae	86	36.44		
Grand Total	236	100.00		

Aquatic Invertebrate Summary Data

Site Name: **Schultz Creek**

Site ID: **S-1 6/29/01**

TOTAL ABUNDANCE 236
 Ephemeroptera + Plecoptera +
 Trichoptera (EPT) abundance 130

TOTAL NUMBER OF TAXA 30
 Number EPT taxa 17

TAXONOMIC GROUP COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Misc. Taxa	3	9	3.81
Odonata	0	0	0.00
Ephemeroptera	6	68	28.81
Plecoptera	6	47	19.92
Hemiptera	0	0	0.00
Megaloptera	0	0	0.00
Trichoptera	5	15	6.36
Lepidoptera	0	0	0.00
Coleoptera	1	7	2.97
Diptera	1	4	1.69
Chironomidae	8	86	36.44

RATIOS OF TAX GROUP ABUNDANCES

EPT/Chironomidae 1.51

FUNCTIONAL FEEDING GROUP (FFG) COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Predator	8	28	11.86
Parasite	0	0	0.00
Collector-gatherer	14	106	44.92
Collector-filterer	0	0	0.00
Macrophyte-herbivore	0	0	0.00
Piercer-herbivore	0	0	0.00
Scraper	3	51	21.61
Shredder	4	42	17.80
Xylophage	0	0	0.00
Omnivore	1	9	3.81
Unknown	0	0	0.00

RATIOS OF FFG ABUNDANCES

Scraper/Collector-filterer #DIV/0!
 Scraper/(Scraper + C.filterer) 1.00
 Shredder/Total organisms 0.08

CONTRIBUTION OF DOMINANT TAXA

TAXON	ABUNDANCE	PERCENT
<i>Micropsectra</i> sp.	62	26.27
<i>Cinygmula</i> sp.	47	19.92
<i>Yoraperla</i> sp.	22	9.32
<i>Visoka cataractae</i>	12	5.08
Eukiefferiella Brehmi Gr.	9	3.81
SUBTOTAL 5 DOMINANTS	152	64.41
<i>Baetis tricaudatus</i>	7	2.97
<i>Heterlimnius</i> sp.	7	2.97
<i>Brillia</i> sp.	7	2.97
<i>Drunella doddsi</i>	6	2.54
Doroneuria sp.	6	2.54
TOTAL DOMINANTS	185	78.39

SAPROBIC INDICES

Hilsenhoff Biotic Index 3.91

DIVERSITY MEASURES

Shannon H (loge) 2.25
 Shannon H (log2) 3.25
 Evenness 0.66
 Simpson D 0.11

COMMUNITY VOLTINISM ANALYSIS

TYPE	ABUNDANCE	PERCENT
Multivoltine	74	31.25
Univoltine	141	59.85
Semivoltine	21	8.90

	#TAXA	ABUNDANCE	PERCENT
Tolerant	1	7	2.97
Intolerant	7	52	22.03
Clinger	11	104	44.07

Aquatic Invertebrate Taxonomic Data

Site Name: Seven Mile Creek

Site ID: Sv-1 7/9/01

Approx. percent of sample used: 13

Taxon	Quantity	Percent	HBI	FFG
<i>Polycelis coronata</i>	16	5.32	4	CG
<i>Limnodrilus hoffmeisteri</i>	6	1.99	9	CG
Sphaeriidae	18	5.98	8	CG
<i>Fossaria</i> sp.	1	0.33	6	CG
Total Misc. Taxa	41	13.62		
<i>Baetis tricaudatus</i>	1	0.33	6	CG
<i>Centroptilum</i> sp.	2	0.66	2	CG
<i>Drunella coloradensis</i>	4	1.33	0	CG
<i>Drunella grandis</i>	3	1.00	2	CG
<i>Serratella tibialis</i>	5	1.66	2	CG
<i>Cinygmula</i> sp.	1	0.33	4	SC
<i>Epeorus albertae</i>	1	0.33	1	SC
<i>Paraleptophlebia</i> sp.	1	0.33	4	CG
Total Ephemeroptera	18	5.98		
<i>Amphinemura</i> sp.	1	0.33	2	SH
<i>Zapada cinctipes</i>	2	0.66	2	SH
Perlodidae-early instar	1	0.33	2	PR
Total Plecoptera	4	1.33		
<i>Brachycentrus americanus</i>	10	3.32	1	OM
<i>Micrasema</i> sp.	37	12.29	1	MH
<i>Ochrotrichia</i> sp.	3	1.00	4	PH
<i>Lepidostoma</i> sp.-panel case larvae	1	0.33	1	SH
<i>Lepidostoma</i> sp.-turret case larvae	1	0.33	2	SH
<i>Rhyacophila Brunnea</i> Gr.	1	0.33	1	PR
<i>Rhyacophila narvae</i>	2	0.66	1	PR
<i>Neophylax occidentis</i>	1	0.33	1	SC
Total Trichoptera	56	18.60		
<i>Cleptelmis addenda</i>	21	6.98	4	CG
<i>Heterlimnius</i> sp.	27	8.97	4	CG
<i>Lara avara</i>	1	0.33	4	SH
Total Coleoptera	49	16.28		
Ceratopogoninae	2	0.66	6	PR
<i>Chelifera</i> sp.	1	0.33	6	PR
<i>Simulium</i> sp.	2	0.66	6	CF
<i>Hexatoma</i> sp.	1	0.33	2	PR
<i>Limnophila</i> sp.	1	0.33	6	MH
<i>Ormosia</i> sp.	1	0.33	3	CG
Total Diptera	8	2.66		
<i>Brillia</i> sp.	4	1.33	5	SH
<i>Cricotopus</i> (Isocladius) Gr.	1	0.33	7	CG
<i>Cricotopus nostococladus</i>	33	10.96	3	PH
<i>Eukiefferiella Gracei</i> Gr.	32	10.63	4	OM
<i>Orthocladus</i> sp.	16	5.32	6	CG
<i>Pagastia</i> sp.	25	8.31	1	CG
<i>Rheotanytarsus</i> sp.	2	0.66	6	CF
<i>Thienemannimyia</i> Gr.	6	1.99	6	PR
<i>Tvetenia</i> sp.	6	1.99	5	CG
Total Chironomidae	125	41.53		
Grand Total	301	100.00		

Aquatic Invertebrate Summary Data

Site Name: Seven Mile Creek

Site ID: Sv-1 7/9/01

TOTAL ABUNDANCE 301

Ephemeroptera + Plecoptera +
Trichoptera (EPT) abundance 78

TOTAL NUMBER OF TAXA 41

Number EPT taxa 19

TAXONOMIC GROUP COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Misc. Taxa	4	41	13.62
Odonata	0	0	0.00
Ephemeroptera	8	18	5.98
Plecoptera	3	4	1.33
Hemiptera	0	0	0.00
Megaloptera	0	0	0.00
Trichoptera	8	56	18.60
Lepidoptera	0	0	0.00
Coleoptera	3	49	16.28
Diptera	6	8	2.66
Chironomidae	9	125	41.53

RATIOS OF TAX GROUP ABUNDANCES

EPT/Chironomidae 0.62

FUNCTIONAL FEEDING GROUP (FFG) COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Predator	7	14	4.65
Parasite	0	0	0.00
Collector-gatherer	17	154	51.16
Collector-filterer	2	4	1.33
Macrophyte-herbivore	2	38	12.62
Piercer-herbivore	2	36	11.96
Scraper	3	3	1.00
Shredder	6	10	3.32
Xylophage	0	0	0.00
Omnivore	2	42	13.95
Unknown	0	0	0.00

RATIOS OF FFG ABUNDANCES

Scraper/Collector-filterer 0.75
Scraper/(Scraper + C.filterer) 0.43
Shredder/Total organisms 0.01

CONTRIBUTION OF DOMINANT TAXA

TAXON	ABUNDANCE	PERCENT
<i>Micrasema</i> sp.	37	12.29
<i>Cricotopus nostococladus</i>	33	10.96
<i>Eukiefferiella Gracei</i> Gr.	32	10.63
<i>Heterlimnius</i> sp.	27	8.97
<i>Pagastia</i> sp.	25	8.31
SUBTOTAL 5 DOMINANTS	154	51.16
<i>Cleptelmis addenda</i>	21	6.98
Sphaeriidae	18	5.98
<i>Polycelis coronata</i>	16	5.32
<i>Orthocladus</i> sp.	16	5.32
<i>Brachycentrus americanus</i>	10	3.32
TOTAL DOMINANTS	235	78.07

SAPROBIC INDICES

Hilsenhoff Biotic Index 3.54

DIVERSITY MEASURES

Shannon H (loge) 3.00
Shannon H (log2) 4.33
Evenness 0.81
Simpson D 0.07

COMMUNITY VOLITINISM ANALYSIS

TYPE	ABUNDANCE	PERCENT
Multivoltine	114	37.96
Univoltine	117	38.95
Semivoltine	70	23.09

	#TAXA	ABUNDANCE	PERCENT
Tolerant	6	29	9.63
Intolerant	2	34	11.30
Clinger	17	122	40.53

Aquatic Invertebrate Taxonomic Data

Site Name: Seven Mile Creek

Site ID: Sv-3 7/9/01

Approx. percent of sample used: 13

Taxon	Quantity	Percent	HBI	FFG
<i>Polycelis coronata</i>	14	4.61	4	CG
Nematoda	1	0.33	5	PA
Sphaeriidae	2	0.66	8	CG
<i>Gyraulus</i> sp.	4	1.32	8	SC
Total Misc. Taxa	21	6.91		
<i>Baetis tricaudatus</i>	4	1.32	6	CG
<i>Dipheter</i> sp.	1	0.33	4	CG
<i>Drunella coloradensis</i>	8	2.63	0	CG
<i>Drunella spinifera</i>	2	0.66	0	PR
<i>Serratella tibialis</i>	6	1.97	2	CG
<i>Paraleptophlebia</i> sp.	1	0.33	4	CG
<i>Ameletus</i> sp.	1	0.33	0	CG
Total Ephemeroptera	23	7.57		
<i>Suwallia</i> sp.	6	1.97	0	PR
<i>Amphinemura</i> sp.	4	1.32	2	SH
Zapada Oregonensis Gr.	1	0.33	2	SH
<i>Doroneuria</i> sp.	2	0.66	1	PR
Perlodidae-early instar	3	0.99	2	PR
<i>Kogotus</i> sp.	3	0.99	2	PR
Total Plecoptera	19	6.25		
<i>Brachycentrus americanus</i>	80	26.32	1	OM
<i>Micrasema</i> sp.	2	0.66	1	MH
<i>Psychoglypha subborealis</i>	1	0.33	2	OM
<i>Wormaldia</i> sp.	4	1.32	3	CF
Rhyacophila Brunnea Gr.	3	0.99	1	PR
<i>Rhyacophila narvae</i>	3	0.99	1	PR
Total Trichoptera	93	30.59		
<i>Cleptelmis addenda</i>	11	3.62	4	CG
<i>Heterolimnius</i> sp.	51	16.78	4	CG
Total Coleoptera	62	20.39		
<i>Antocha</i> sp.	3	0.99	3	CG
<i>Hexatoma</i> sp.	2	0.66	2	PR
<i>Tipula</i> sp.	1	0.33	4	OM
Total Diptera	6	1.97		
<i>Cricotopus nostococladius</i>	13	4.28	3	PH
Eukiefferiella Gracei Gr.	4	1.32	4	OM
<i>Micropsectra</i> sp.	1	0.33	7	CG
<i>Microtendipes</i> sp.	1	0.33	6	CG
<i>Orthocladius</i> sp.	49	16.12	6	CG
<i>Pagastia</i> sp.	2	0.66	1	CG
<i>Parametrioctenus</i> sp.	2	0.66	5	CG
<i>Paratanytarsus</i> sp.	5	1.64	6	UN
<i>Rheocricotopus</i> sp.	2	0.66	6	OM
Thienemannimyia Gr.	1	0.33	6	PR
Total Chironomidae	80	26.32		
Grand Total	304	100.00		

Aquatic Invertebrate Summary Data

Site Name: Seven Mile Creek

Site ID: Sv-3 7/9/01

TOTAL ABUNDANCE	304
Ephemeroptera + Plecoptera + Trichoptera (EPT) abundance	135
TOTAL NUMBER OF TAXA	38
Number EPT taxa	19

TAXONOMIC GROUP COMPOSITION

GROUP	#TAXA	ABUNDAN	PERCENT
Misc. Taxa	4	21	6.91
Odonata	0	0	0.00
Ephemeroptera	7	23	7.57
Plecoptera	6	19	6.25
Hemiptera	0	0	0.00
Megaloptera	0	0	0.00
Trichoptera	6	93	30.59
Lepidoptera	0	0	0.00
Coleoptera	2	62	20.39
Diptera	3	6	1.97
Chironomidae	10	80	26.32

RATIOS OF TAX GROUP ABUNDANCES

EPT/Chironomidae	1.69
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FUNCTIONAL FEEDING GROUP (FFG) COMPOSITION

GROUP	#TAXA	ABUNDAN	PERCENT
Predator	9	25	8.22
Parasite	1	1	0.33
Collector-gatherer	16	157	51.64
Collector-filterer	1	4	1.32
Macrophyte-herbivore	1	2	0.66
Piercer-herbivore	1	13	4.28
Scraper	1	4	1.32
Shredder	2	5	1.64
Xylophage	0	0	0.00
Omnivore	5	88	28.95
Unknown	1	5	1.64

RATIOS OF FFG ABUNDANCES

Scraper/Collector-filterer	1.00
Scraper/(Scraper + C.filterer)	0.50
Shredder/Total organisms	0.01

CONTRIBUTION OF DOMINANT TAXA

TAXON	ABUNDANCE	PERCENT
<i>Brachycentrus americanus</i>	80	26.32
<i>Heterlimnius</i> sp.	51	16.78
<i>Orthocladius</i> sp.	49	16.12
<i>Polycelis coronata</i>	14	4.61
<i>Cricotopus nastococladus</i>	13	4.28
SUBTOTAL 5 DOMINANTS	207	68.09
<i>Cleptelmis addenda</i>	11	3.62
<i>Drunella coloradensis</i>	8	2.63
<i>Serratella tibialis</i>	6	1.97
<i>Suwallia</i> sp.	6	1.97
<i>Paratanytarsus</i> sp.	5	1.64
TOTAL DOMINANTS	243	79.93

SAPROBIC INDICES

Hilsenhoff Biotic Index	3.18
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DIVERSITY MEASURES

Shannon H (loge)	2.27
Shannon H (log2)	3.27
Evenness	0.62
Simpson D	0.11

COMMUNITY VOLTINISM ANALYSIS

TYPE	ABUNDANCE	PERCENT
Multivoltine	79	25.90
Univoltine	77	25.41
Semivoltine	148	48.68

	#TAXA	ABUNDANCE	PERCENT
Tolerant	3	19	6.25
Intolerant	4	20	6.58
Clinger	12	176	57.89

Aquatic Invertebrate Taxonomic Data

Site Name: Corral Creek

Site ID: C-1 7/10/01

Approx. percent of sample used: 50

Taxon	Quantity	Percent	HBI	FFG
<i>Polycelis coronata</i>	1	0.29	4	CG
<i>Acari</i>	1	0.29	5	PA
Total Misc. Taxa	2	0.59		
<i>Baetis tricaudatus</i>	17	5.01	6	CG
<i>Drunella coloradensis</i>	23	6.78	0	CG
<i>Drunella spinifera</i>	2	0.59	0	PR
<i>Serratella tibialis</i>	10	2.95	2	CG
<i>Cinygmula</i> sp.	23	6.78	4	SC
<i>Epeorus</i> sp.- damaged	8	2.36	0	SC
<i>Epeorus longimanus</i>	1	0.29	1	SC
<i>Ameletus</i> sp.	1	0.29	0	CG
Total Ephemeroptera	85	25.07		
<i>Suwallia</i> sp.	4	1.18	0	PR
<i>Sweltsa</i> sp.	9	2.65	1	PR
<i>Zapada cinctipes</i>	3	0.88	2	SH
<i>Megarocyis</i> sp.	16	4.72	2	PR
<i>Yoraperla</i> sp.	5	1.47	1	SH
Total Plecoptera	37	10.91		
<i>Parapsyche elsis</i>	1	0.29	1	PR
<i>Micrasema</i> sp.	1	0.29	1	MH
<i>Rhyacophila</i> -early instars or pupae	4	1.18	0	PR
<i>Rhyacophila</i> Betteni Gr.	1	0.29	1	PR
<i>Rhyacophila</i> Brunnea Gr.	7	2.06	1	PR
<i>Rhyacophila narvae</i>	10	2.95	1	PR
Total Trichoptera	24	7.08		
Elmidae - early instars	10	2.95	4	CG
<i>Heterolimnius</i> sp.	79	23.30	4	CG
Total Coleoptera	89	26.25		
Ceratopogoninae	1	0.29	6	PR
Empididae - pupae	1	0.29	6	PR
<i>Hexatoma</i> sp.	9	2.65	2	PR
<i>Linnophila</i> sp.	1	0.29	6	MH
Total Diptera	12	3.54		
<i>Cricotopus</i> sp.	14	4.13	7	CG
<i>Cricotopus nostococladus</i>	1	0.29	3	PH
<i>Eukiefferiella</i> Brehmi Gr.	7	2.06	4	OM
<i>Micropsectra</i> sp.	37	10.91	7	CG
<i>Parametriocnemus</i> sp.	18	5.31	5	CG
<i>Stempellinella</i> sp.	13	3.83	4	UN
Total Chironomidae	90	26.55		
Grand Total	339	100.00		

Aquatic Invertebrate Summary Data

Site Name: Corral Creek

Site ID: C-1 7/10/01

TOTAL ABUNDANCE 339

Ephemeroptera + Plecoptera +
Trichoptera (EPT) abundance 146

TOTAL NUMBER OF TAXA 33

Number EPT taxa 19

TAXONOMIC GROUP COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Misc. Taxa	2	2	0.59
Odonata	0	0	0.00
Ephemeroptera	8	85	25.07
Plecoptera	5	37	10.91
Hemiptera	0	0	0.00
Megaloptera	0	0	0.00
Trichoptera	6	24	7.08
Lepidoptera	0	0	0.00
Coleoptera	2	89	26.25
Diptera	4	12	3.54
Chironomidae	6	90	26.55

RATIOS OF TAX GROUP ABUNDANCES

EPT/Chironomidae 1.62

FUNCTIONAL FEEDING GROUP (FFG) COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Predator	12	65	19.17
Parasite	1	1	0.29
Collector-gatherer	10	210	61.95
Collector-filterer	0	0	0.00
Macrophyte-herbivore	2	2	0.59
Piercer-herbivore	1	1	0.29
Scraper	3	32	9.44
Shredder	2	8	2.36
Xylophage	0	0	0.00
Omnivore	1	7	2.06
Unknown	1	13	3.83

RATIOS OF FFG ABUNDANCES

Scraper/Collector-filterer #DIV/0!
Scraper/(Scraper + C.filterer) 1.00
Shredder/Total organisms 0.01

CONTRIBUTION OF DOMINANT TAXA

TAXON	ABUNDANCE	PERCENT
<i>Heterlimnius</i> sp.	79	23.30
<i>Micropsectra</i> sp.	37	10.91
<i>Drunella coloradensis</i>	23	6.78
<i>Cinygmula</i> sp.	23	6.78
<i>Parametriocnemus</i> sp.	18	5.31
SUBTOTAL 5 DOMINANTS	180	53.10
<i>Baetis tricaudatus</i>	17	5.01
<i>Megarcys</i> sp.	16	4.72
<i>Cricotopus</i> sp.	14	4.13
<i>Stempellinella</i> sp.	13	3.83
<i>Serratella tibialis</i>	10	2.95
TOTAL DOMINANTS	250	73.75

SAPROBIC INDICES

Hilsenhoff Biotic Index 3.59

DIVERSITY MEASURES

Shannon H (log_e) 2.48
Shannon H (log₂) 3.57
Evenness 0.71
Simpson D 0.08

COMMUNITY VOLTINISM ANALYSIS

TYPE	ABUNDANCE	PERCENT
Multivoltine	82	24.26
Univoltine	156	45.94
Semivoltine	101	29.79

	#TAXA	ABUNDANCE	PERCENT
Tolerant	2	18	5.31
Intolerant	4	23	6.78
Clinger	17	215	63.42

Aquatic Invertebrate Taxonomic Data

Site Name: Corral Creek

Site ID: C-4 7/10/00

Approx. percent of sample used: 100

Taxon	Quantity	Percent	HBI	FFG
Lumbriculidae	1	0.77	8	CG
Sphaeriidae	6	4.62	8	CG
Total Misc. Taxa	7	5.38		
<i>Baetis tricandatus</i>	1	0.77	6	CG
<i>Dipheter hageni</i>	1	0.77	5	CG
<i>Drunella spinifera</i>	1	0.77	0	PR
<i>Serratella tibialis</i>	6	4.62	2	CG
<i>Cinygmula</i> sp.	18	13.85	4	SC
<i>Ameletus</i> sp.	1	0.77	0	CG
Total Ephemeroptera	28	21.54		
<i>Suwallia</i> sp.	3	2.31	0	PR
<i>Sweltsa</i> sp.	3	2.31	1	PR
<i>Megarcys</i> sp.	3	2.31	2	PR
<i>Yoraperla</i> sp.	1	0.77	1	SH
Total Plecoptera	10	7.69		
<i>Wormaldia</i> sp.	10	7.69	3	CF
Total Trichoptera	10	7.69		
<i>Heterlimnius</i> sp.	36	27.69	4	CG
Total Coleoptera	36	27.69		
<i>Hexatoma</i> sp.	6	4.62	2	PR
Total Diptera	6	4.62		
<i>Cricotopus nostococladius</i>	1	0.77	3	PH
<i>Micropsectra</i> sp.	25	19.23	7	CG
<i>Parametrioctenus</i> sp.	6	4.62	5	CG
<i>Thienemanniella</i> sp.	1	0.77	6	CG
Total Chironomidae	33	25.38		
Grand Total	130	100.00		

Aquatic Invertebrate Summary Data

Site Name: Corral Creek

Site ID: C-4 7/10/00

TOTAL ABUNDANCE 130
 Ephemeroptera + Plecoptera +
 Trichoptera (EPT) abundance 48

TOTAL NUMBER OF TAXA 19
 Number EPT taxa 11

TAXONOMIC GROUP COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Misc. Taxa	2	7	5.38
Odonata	0	0	0.00
Ephemeroptera	6	28	21.54
Plecoptera	4	10	7.69
Hemiptera	0	0	0.00
Megaloptera	0	0	0.00
Trichoptera	1	10	7.69
Lepidoptera	0	0	0.00
Coleoptera	1	36	27.69
Diptera	1	6	4.62
Chironomidae	4	33	25.38

RATIOS OF TAX GROUP ABUNDANCES

EPT/Chironomidae 1.45

FUNCTIONAL FEEDING GROUP (FFG) COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Predator	5	16	12.31
Parasite	0	0	0.00
Collector-gatherer	10	84	64.62
Collector-filterer	1	10	7.69
Macrophyte-herbivore	0	0	0.00
Piercer-herbivore	1	1	0.77
Scraper	1	18	13.85
Shredder	1	1	0.77
Xylophage	0	0	0.00
Omnivore	0	0	0.00
Unknown	0	0	0.00

RATIOS OF FFG ABUNDANCES

Scraper/Collector-filterer 1.80
 Scraper/(Scraper + C.filterer) 0.64
 Shredder/Total organisms 0.01

CONTRIBUTION OF DOMINANT TAXA

TAXON	ABUNDANCE	PERCENT
<i>Heterlimnius</i> sp.	36	27.69
<i>Micropsectra</i> sp.	25	19.23
<i>Cinygmula</i> sp.	18	13.85
<i>Wormaldia</i> sp.	10	7.69
Sphaeriidae	6	4.62
SUBTOTAL 5 DOMINANTS	95	73.08
<i>Serratella tibialis</i>	6	4.62
<i>Hexatoma</i> sp.	6	4.62
<i>Parametriocnemus</i> sp.	6	4.62
<i>Suwallia</i> sp.	3	2.31
Sweltsa sp.	3	2.31
TOTAL DOMINANTS	119	91.54

SAPROBIC INDICES

Hilsenhoff Biotic Index 4.32

DIVERSITY MEASURES

Shannon H (log_e) 1.91
 Shannon H (log₂) 2.76
 Evenness 0.65
 Simpson D 0.14

COMMUNITY VOLUNTINISM ANALYSIS

TYPE	ABUNDANCE	PERCENT
Multivoltine	26	20.19
Univoltine	65	49.81
Semivoltine	39	30.00

	#TAXA	ABUNDANCE	PERCENT
Tolerant	1	1	0.77
Intolerant	3	5	3.85
Clinger	7	75	57.69

Aquatic Invertebrate Taxonomic Data

Site Name: Twelvemile Creek

Site ID: T-1 6/28/01

Approx. percent of sample used: 100

Taxon	Quantity	Percent	IIBI	FFG
<i>Polycelis coronata</i>	2	1.05	4	CG
Tubificidae - immature	14	7.37	9	CG
Total Misc. Taxa	16	8.42		
<i>Baetis tricaudatus</i>	3	1.58	6	CG
<i>Drunella coloradensis</i>	8	4.21	0	CG
<i>Drunella doddsi</i>	1	0.53	0	CG
<i>Ephemerella inermis</i>	1	0.53	1	CG
<i>Serratella tibialis</i>	2	1.05	2	CG
<i>Cinygmula</i> sp.	18	9.47	4	SC
<i>Epeorus albertae</i>	2	1.05	1	SC
<i>Epeorus grandis</i>	1	0.53	0	SC
<i>Rhithrogena</i> sp.	1	0.53	0	SC
Total Ephemeroptera	37	19.47		
<i>Paraperla</i> sp.	1	0.53	0	PR
<i>Suwallia</i> sp.	3	1.58	0	PR
<i>Sweltsa</i> sp.	7	3.68	1	PR
<i>Despaxia augusta</i>	1	0.53	0	SH
<i>Visoka cataractae</i>	1	0.53	0	SH
<i>Zapada columbiana</i>	4	2.11	2	SH
Perlidae - early instars	1	0.53	1	PR
<i>Megarcys</i> sp.	3	1.58	2	PR
<i>Yoraperla</i> sp.	8	4.21	1	SH
Total Plecoptera	29	15.26		
<i>Parapsyche elsis</i>	6	3.16	1	PR
<i>Micrasema</i> sp.	2	1.05	1	MH
Rhyacophila-early instars or pupae	1	0.53	0	PR
Rhyacophila Alberta Gr.	1	0.53	0	PR
Rhyacophila Brunnea Gr.	1	0.53	1	PR
<i>Rhyacophila narvae</i>	3	1.58	1	PR
<i>Rhyacophila pellisa</i>	1	0.53	1	PR
Total Trichoptera	15	7.89		
<i>Cleptelmis</i> sp.	1	0.53	4	CG
<i>Heterlimnius</i> sp.	5	2.63	4	CG
Total Coleoptera	6	3.16		
Empididae - pupae	1	0.53	6	PR
<i>Chelifera</i> sp.	5	2.63	6	PR
<i>Clinocera</i> sp.	3	1.58	6	PR
<i>Simulium</i> sp.	1	0.53	6	CF
<i>Dicranota</i> sp.	2	1.05	3	PR
<i>Hexatoma</i> sp.	7	3.68	2	PR
Total Diptera	19	10.00		
<i>Corynoneura</i> sp.	3	1.58	7	CG
<i>Cricotopus</i> sp.	12	6.32	7	CG
Cricotopus (Isocladius) Gr.	1	0.53	7	CG
<i>Cricotopus nostococladius</i>	1	0.53	3	PH
Eukiefferiella Brehmi Gr.	4	2.11	4	OM
Eukiefferiella Devonica Gr.	4	2.11	4	OM
<i>Micropsectra</i> sp.	32	16.84	7	CG
Thienemannimyia Gr.	3	1.58	6	PR
<i>Tvetenia</i> sp.	8	4.21	5	CG
Total Chironomidae	68	35.79		
Grand Total	190	100.00		

Aquatic Invertebrate Summary Data

Site Name: Twelvemile Creek Site ID: T-1 6/28/01

TOTAL ABUNDANCE	190
Ephemeroptera + Plecoptera + Trichoptera (EPT) abundance	81
TOTAL NUMBER OF TAXA	44
Number EPT taxa	25

TAXONOMIC GROUP COMPOSITION

GROUP	#TAXA	ABUNDAN	PERCENT
Misc. Taxa	2	16	8.42
Odonata	0	0	0.00
Ephemeroptera	9	37	19.47
Plecoptera	9	29	15.26
Hemiptera	0	0	0.00
Megaloptera	0	0	0.00
Trichoptera	7	15	7.89
Lepidoptera	0	0	0.00
Coleoptera	2	6	3.16
Diptera	6	19	10.00
Chironomidae	9	68	35.79

RATIOS OF TAX GROUP ABUNDANCES

EPT/Chironomidae	1.19
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FUNCTIONAL FEEDING GROUP (FFG) COMPOSITION

GROUP	#TAXA	ABUNDAN	PERCENT
Predator	17	49	25.79
Parasite	0	0	0.00
Collector-gatherer	14	93	48.95
Collector-filterer	1	1	0.53
Macrophyte-herbivore	1	2	1.05
Piercer-herbivore	1	1	0.53
Scraper	4	22	11.58
Shredder	4	14	7.37
Xylophage	0	0	0.00
Omnivore	2	8	4.21
Unknown	0	0	0.00

RATIOS OF FFG ABUNDANCES

Scraper/Collector-filterer	22.00
Scraper/(Scraper + C.filterer)	0.96
Shredder/Total organisms	0.04

CONTRIBUTION OF DOMINANT TAXA

TAXON	ABUNDANCE	PERCENT
<i>Micropsectra</i> sp.	32	16.84
<i>Cinygmula</i> sp.	18	9.47
Tubificidae - immature	14	7.37
<i>Cricotopus</i> sp.	12	6.32
<i>Drunella coloradensis</i>	8	4.21
SUBTOTAL 5 DOMINANTS	84	44.21
<i>Yoraperla</i> sp.	8	4.21
<i>Tvetenia</i> sp.	8	4.21
<i>Sweltsa</i> sp.	7	3.68
<i>Hexatoma</i> sp.	7	3.68
<i>Parapsyche elsis</i>	6	3.16
TOTAL DOMINANTS	120	63.16

SAPROBIC INDICES

Hilsenhoff Biotic Index	4.25
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DIVERSITY MEASURES

Shannon H (loge)	3.82
Shannon H (log2)	5.51
Evenness	1.01
Simpson D	0.05

COMMUNITY VOLTINISM ANALYSIS

TYPE	ABUNDANCE	PERCENT
Multivoltine	55	29.08
Univoltine	118	62.24
Semivoltine	17	8.68

	#TAXA	ABUNDANCE	PERCENT
Tolerant	2	4	2.11
Intolerant	11	28	14.74
Clinger	24	84	44.21

Aquatic Invertebrate Taxonomic Data

Site Name: Twelve Mile Creek

Site ID: T-2 7/10/01

Approx. percent of sample used: 100

Taxon	Quantity	Percent	HBI	FFG
<i>Polycelis coronata</i>	2	2.08	4	CG
Tubificidae - immature	5	5.21	9	CG
Total Misc. Taxa	7	7.29		
<i>Baetis tricaudatus</i>	4	4.17	6	CG
<i>Drunella coloradensis</i>	1	1.04	0	CG
<i>Ephemerella</i> sp.	4	4.17	1	CG
<i>Cinygmula</i> sp.	7	7.29	4	SC
<i>Rhithrogena</i> sp.	1	1.04	0	SC
<i>Ameletus</i> sp.	3	3.13	0	CG
Total Ephemeroptera	20	20.83		
<i>Sweltsa</i> sp.	6	6.25	1	PR
<i>Despaxia augusta</i>	5	5.21	0	SH
<i>Zapada columbiana</i>	4	4.17	2	SH
Perlodidae-early instar	3	3.13	2	PR
<i>Yoraperla</i> sp.	9	9.38	1	SH
Total Plecoptera	27	28.13		
<i>Parapsyche elsis</i>	3	3.13	1	PR
<i>Rhyacophila Betteni</i> Gr.	1	1.04	1	PR
<i>Rhyacophila Hyalinata</i> Gr.	1	1.04	1	PR
<i>Rhyacophila narvae</i>	2	2.08	1	PR
Total Trichoptera	7	7.29		
<i>Dicranota</i> sp.	1	1.04	3	PR
<i>Hexatoma</i> sp.	4	4.17	2	PR
Total Diptera	5	5.21		
<i>Brillia</i> sp.	2	2.08	5	SH
<i>Micropsectra</i> sp.	23	23.96	7	CG
<i>Rheocricotopus</i> sp.	1	1.04	6	OM
<i>Thienemamiella</i> sp.	1	1.04	6	CG
<i>Thienemannimyia</i> Gr.	2	2.08	6	PR
<i>Tvetenia</i> sp.	1	1.04	5	CG
Total Chironomidae	30	31.25		
Grand Total	96	100.00		

Aquatic Invertebrate Summary Data

Site Name: Twelve Mile Creek **Site ID: T-2 7/10/01**

TOTAL ABUNDANCE	96
Ephemeroptera + Plecoptera + Trichoptera (EPT) abundance	54
TOTAL NUMBER OF TAXA	25
Number EPT taxa	15

TAXONOMIC GROUP COMPOSITION			
GROUP	#TAXA	ABUNDANCE	PERCENT
Misc. Taxa	2	7	7.29
Odonata	0	0	0.00
Ephemeroptera	6	20	20.83
Plecoptera	5	27	28.13
Hemiptera	0	0	0.00
Megaloptera	0	0	0.00
Trichoptera	4	7	7.29
Lepidoptera	0	0	0.00
Coleoptera	0	0	0.00
Diptera	2	5	5.21
Chironomidae	6	30	31.25

RATIOS OF TAX GROUP ABUNDANCES	
EPT/Chironomidae	1.80

FUNCTIONAL FEEDING GROUP (FFG) COMPOSITION			
GROUP	#TAXA	ABUNDANCE	PERCENT
Predator	9	23	23.96
Parasite	0	0	0.00
Collector-gatherer	9	44	45.83
Collector-filterer	0	0	0.00
Macrophyte-herbivore	0	0	0.00
Piercer-herbivore	0	0	0.00
Scraper	2	8	8.33
Shredder	4	20	20.83
Xylophage	0	0	0.00
Omnivore	1	1	1.04
Unknown	0	0	0.00

RATIOS OF FFG ABUNDANCES	
Scraper/Collector-filterer	#DIV/0!
Scraper/(Scraper + C. filterer)	1.00
Shredder/Total organisms	0.22

CONTRIBUTION OF DOMINANT TAXA		
TAXON	ABUNDANCE	PERCENT
<i>Micropsectra</i> sp.	23	23.96
<i>Yoraperla</i> sp.	9	9.38
<i>Cinygmula</i> sp.	7	7.29
<i>Sweltsa</i> sp.	6	6.25
Tubificidae - immature	5	5.21
SUBTOTAL 5 DOMINANTS	50	52.08
<i>Despaxia augusta</i>	5	5.21
<i>Baetis tricaudatus</i>	4	4.17
<i>Ephemerella</i> sp.	4	4.17
<i>Zapada columbiana</i>	4	4.17
<i>Ameletus</i> sp.	3	3.13
TOTAL DOMINANTS	70	72.92

SAPROBIC INDICES	
Hilsenhoff Biotic Index	3.71

DIVERSITY MEASURES	
Shannon H (loge)	2.79
Shannon H (log2)	4.03
Evenness	0.87
Simpson D	0.08

COMMUNITY VOLTINISM ANALYSIS		
TYPE	ABUNDANCE	PERCENT
Multivoltine	28	28.65
Univoltine	64	66.15
Semivoltine	5	5.21

	#TAXA	ABUNDANCE	PERCENT
Tolerant	1	4	4.17
Intolerant	4	21	21.88
Clinger	9	29	30.21

Aquatic Invertebrate Taxonomic Data

Site Name: Twelve Mile Creek

Site ID: T-4 7/10/01

Approx. percent of sample used: 100

Taxon	Quantity	Percent	HBI	FFG
<i>Baetis tricaudatus</i>	4	2.58	6	CG
<i>Drunella grandis</i>	1	0.65	2	CG
<i>Ephemerella</i> sp.	2	1.29	1	CG
<i>Serratella tibialis</i>	4	2.58	2	CG
<i>Cinygmula</i> sp.	1	0.65	4	SC
<i>Epeorus longimanus</i>	1	0.65	1	SC
<i>Paraleptophlebia</i> sp.	3	1.94	4	CG
Total Ephemeroptera	16	10.32		
<i>Hesperoperla pacifica</i>	1	0.65	2	PR
Total Plecoptera	1	0.65		
<i>Micrasema</i> sp.	2	1.29	1	MH
Total Trichoptera	2	1.29		
<i>Cleptelmis</i> sp.	3	1.94	4	CG
<i>Lara avara</i>	1	0.65	4	SH
Total Coleoptera	4	2.58		
<i>Simulium</i> sp.	1	0.65	6	CF
Total Diptera	1	0.65		
<i>Cricotopus (Isocladius) Gr.</i>	12	7.74	7	CG
<i>Eukiefferiella Devonica Gr.</i>	1	0.65	4	OM
<i>Eukiefferiella Gracei Gr.</i>	5	3.23	4	OM
<i>Micropsectra</i> sp.	83	53.55	7	CG
<i>Parametrioctenus</i> sp.	2	1.29	5	CG
<i>Paratanytarsus</i> sp.	1	0.65	6	UN
<i>Paratendipes</i> sp.	1	0.65	8	CG
<i>Rheocricotopus</i> sp.	8	5.16	6	OM
<i>Thienemanniella</i> sp.	8	5.16	6	CG
<i>Thienemannimyia Gr.</i>	10	6.45	6	PR
Total Chironomidae	131	84.52		
Grand Total	155	100.00		

Aquatic Invertebrate Summary Data

Site Name: Twelve Mile Creek

Site ID: T-4 7/10/01

TOTAL ABUNDANCE 155
 Ephemeroptera + Plecoptera +
 Trichoptera (EPT) abundance 19

TOTAL NUMBER OF TAXA 22
 Number EPT taxa 9

TAXONOMIC GROUP COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Misc. Taxa	0	0	0.00
Odonata	0	0	0.00
Ephemeroptera	7	16	10.32
Plecoptera	1	1	0.65
Hemiptera	0	0	0.00
Megaloptera	0	0	0.00
Trichoptera	1	2	1.29
Lepidoptera	0	0	0.00
Coleoptera	2	4	2.58
Diptera	1	1	0.65
Chironomidae	10	131	84.52

RATIOS OF TAX GROUP ABUNDANCES

EPT/Chironomidae 0.15

FUNCTIONAL FEEDING GROUP (FFG) COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Predator	2	11	7.10
Parasite	0	0	0.00
Collector-gatherer	11	123	79.35
Collector-filterer	1	1	0.65
Macrophyte-herbivore	1	2	1.29
Piercer-herbivore	0	0	0.00
Scraper	2	2	1.29
Shredder	1	1	0.65
Xylophage	0	0	0.00
Omnivore	3	14	9.03
Unknown	1	1	0.65

RATIOS OF FFG ABUNDANCES

Scraper/Collector-filterer 2.00
 Scraper/(Scraper + C.filterer) 0.67
 Shredder/Total organisms 0.00

CONTRIBUTION OF DOMINANT TAXA

TAXON	ABUNDANCE	PERCENT
<i>Micropsectra</i> sp.	83	53.55
<i>Cricotopus</i> (<i>Isocladus</i>) Gr.	12	7.74
<i>Thienemannimyia</i> Gr.	10	6.45
<i>Rheocricotopus</i> sp.	8	5.16
<i>Thienemanniella</i> sp.	8	5.16
SUBTOTAL 5 DOMINANTS	121	78.06
<i>Eukiefferiella</i> <i>Gracei</i> Gr.	5	3.23
<i>Baetis</i> <i>tricaudatus</i>	4	2.58
<i>Serratella</i> <i>tibialis</i>	4	2.58
<i>Paraleptophlebia</i> sp.	3	1.94
<i>Cleptelmis</i> sp.	3	1.94
TOTAL DOMINANTS	140	90.33

SAPROBIC INDICES

Hilsenhoff Biotic Index 6.12

DIVERSITY MEASURES

Shannon H (log_e) 1.93
 Shannon H (log₂) 2.78
 Evenness 0.62
 Simpson D 0.30

COMMUNITY VOLTINISM ANALYSIS

TYPE	ABUNDANCE	PERCENT
Multivoltine	101	65.32
Univoltine	49	31.45
Semivoltine	5	3.23

	#TAXA	ABUNDANCE	PERCENT
Tolerant	3	8	5.16
Intolerant	0	0	0.00
Clinger	10	28	18.06

Aquatic Invertebrate Taxonomic Data

Site Name: Deep Creek

Site ID: D-2 7/11/01

Approx. percent of sample used: 33

Taxon	Quantity	Percent	HBI	FFG
Sphaeriidae	2	0.62	8	CG
Total Misc. Taxa	2	0.62		
<i>Baetis flavistriga</i>	5	1.54	5	CG
<i>Dipheter hageni</i>	1	0.31	5	CG
<i>Attenella delantala</i>	12	3.70	2	CG
<i>Caudatella heterocaudata</i>	1	0.31	1	CG
<i>Drunella coloradensis</i>	1	0.31	0	CG
<i>Serratella tibialis</i>	12	3.70	2	CG
<i>Timpanoga hecuba</i>	1	0.31	7	CG
<i>Cinygma</i> sp.	2	0.62	2	SC
<i>Epeorus</i> sp.-early instar	3	0.93	0	SC
Total Ephemeroptera	38	11.73		
<i>Zapada cinctipes</i>	1	0.31	2	SH
<i>Hesperoperla pacifica</i>	3	0.93	2	PR
Total Plecoptera	4	1.23		
<i>Brachycentrus americanus</i>	32	9.88	1	OM
<i>Brachycentrus occidentalis</i>	37	11.42	1	OM
<i>Micrasema</i> sp.	15	4.63	1	MH
<i>Agapetus</i> sp.	5	1.54	0	SC
<i>Helicopsyche borealis</i>	1	0.31	7	SC
Hydropsychidae	4	1.23	4	CF
<i>Ochrotrichia</i> sp.	13	4.01	4	PH
<i>Wormaldia</i> sp.	1	0.31	3	CF
Total Trichoptera	108	33.33		
Elmidae	2	0.62	4	CG
<i>Optioservus</i> sp.	5	1.54	4	SC
<i>Zaitzevia</i> sp.	19	5.86	4	CG
Total Coleoptera	26	8.02		
<i>Chelifera</i> sp.	1	0.31	6	PR
<i>Hexatoma</i> sp.	1	0.31	2	PR
Total Diptera	2	0.62		
<i>Cricotopus</i> sp.	6	1.85	7	CG
<i>Cricotopus (Isocladius)</i> Gr.	1	0.31	7	CG
<i>Cricotopus nostococladius</i>	6	1.85	3	PH
<i>Eukiefferiella Brehmi</i> Gr.	16	4.94	4	OM
<i>Eukiefferiella Devonica</i> Gr.	3	0.93	4	OM
<i>Krenosmittia</i> sp.	1	0.31	1	CG
<i>Pagastia</i> sp.	15	4.63	1	CG
<i>Polypedilum</i> sp.	40	12.35	6	OM
<i>Rheotanytarsus</i> sp.	41	12.65	6	CF
Thienemannimyia Gr.	2	0.62	6	PR
<i>Tvetenia</i> sp.	13	4.01	5	CG
Total Chironomidae	144	44.44		
Grand Total	324	100.00		

Aquatic Invertebrate Summary Data

Site Name: Deep Creek **Site ID: D-2 7/11/01**

TOTAL ABUNDANCE	324
Ephemeroptera + Plecoptera + Trichoptera (EPT) abundance	150
TOTAL NUMBER OF TAXA	36
Number EPT taxa	19

TAXONOMIC GROUP COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Misc. Taxa	1	2	0.62
Odonata	0	0	0.00
Ephemeroptera	9	38	11.73
Plecoptera	2	4	1.23
Hemiptera	0	0	0.00
Megaloptera	0	0	0.00
Trichoptera	8	108	33.33
Lepidoptera	0	0	0.00
Coleoptera	3	26	8.02
Diptera	2	2	0.62
Chironomidae	11	144	44.44

RATIOS OF TAX GROUP ABUNDANCES

EPT/Chironomidae	1.04
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FUNCTIONAL FEEDING GROUP (FFG) COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Predator	4	7	2.16
Parasite	0	0	0.00
Collector-gatherer	15	92	28.40
Collector-filterer	3	46	14.20
Macrophyte-herbivore	1	15	4.63
Piercer-herbivore	2	19	5.86
Scraper	5	16	4.94
Shredder	1	1	0.31
Xylophage	0	0	0.00
Omnivore	5	128	39.51
Unknown	0	0	0.00

RATIOS OF FFG ABUNDANCES

Scraper/Collector-filterer	0.35
Scraper/(Scraper + C.filterer)	0.26
Shredder/Total organisms	0.00

CONTRIBUTION OF DOMINANT TAXA

TAXON	ABUNDANCE	PERCENT
<i>Rheotanytarsus</i> sp.	41	12.65
<i>Polypedilum</i> sp.	40	12.35
<i>Brachycentrus occidentalis</i>	37	11.42
<i>Brachycentrus americanus</i>	32	9.88
<i>Zaitzevia</i> sp.	19	5.86
SUBTOTAL 5 DOMINANTS	169	52.16
<i>Eukiefferiella Brehmi</i> Gr.	16	4.94
<i>Micrasema</i> sp.	15	4.63
<i>Pagastia</i> sp.	15	4.63
<i>Ochrotrichia</i> sp.	13	4.01
<i>Tvetenia</i> sp.	13	4.01
TOTAL DOMINANTS	241	74.38

SAPROBIC INDICES

Hilsenhoff Biotic Index	3.43
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DIVERSITY MEASURES

Shannon H (loge)	2.59
Shannon H (log2)	3.73
Evenness	0.72
Simpson D	0.07

COMMUNITY VOLTINISM ANALYSIS

TYPE	ABUNDANCE	PERCENT
Multivoltine	123	38.04
Univoltine	102	31.40
Semivoltine	99	30.56

	#TAXA	ABUNDANCE	PERCENT
Tolerant	4	38	11.73
Intolerant	2	7	2.16
Clinger	22	254	78.40

Aquatic Invertebrate Taxonomic Data

Site Name: Six Mile Creek

Site ID: S-1 7/9/01

Approx. percent of sample used: 12

Taxon	Quantity	Percent	HBI	FFG
<i>Polycelis coronata</i>	10	3.31	4	CG
Enchytraeidae	13	4.30	4	CG
Acari	2	0.66	5	PA
Total Misc. Taxa	25	8.28		
<i>Diphetor hageni</i>	4	1.32	5	CG
<i>Drunella coloradensis</i>	1	0.33	0	CG
<i>Drunella grandis</i>	1	0.33	2	CG
<i>Serratella tibialis</i>	10	3.31	2	CG
<i>Epeorus longimanus</i>	1	0.33	1	SC
<i>Nixe</i> sp.	1	0.33	2	SC
<i>Ameletus</i> sp.	2	0.66	0	CG
Total Ephemeroptera	20	6.62		
<i>Sweltsa</i> sp.	2	0.66	1	PR
Total Plecoptera	2	0.66		
<i>Brachycentrus americanus</i>	1	0.33	1	OM
<i>Agapetus</i> sp.	2	0.66	0	SC
<i>Ochrotrichia</i> sp.	13	4.30	4	PH
<i>Rhyacophila Brunnea</i> Gr.	7	2.32	1	PR
Total Trichoptera	23	7.62		
<i>Heterlimnius</i> sp.	2	0.66	4	CG
<i>Optioservus</i> sp.	15	4.97	4	SC
<i>Zaitzevia</i> sp.	43	14.24	4	CG
Total Coleoptera	60	19.87		
<i>Hexatoma</i> sp.	3	0.99	2	PR
Total Diptera	3	0.99		
<i>Cricotopus</i> sp.	140	46.36	7	CG
<i>Cricotopus nostococladius</i>	3	0.99	3	PH
<i>Cricotopus brevipalpus</i>	2	0.66	7	CG
<i>Eukiefferiella Gracei</i> Gr.	11	3.64	4	OM
<i>Microsectra</i> sp.	4	1.32	7	CG
<i>Orthocladus</i> sp.	6	1.99	6	CG
<i>Pagastia</i> sp.	1	0.33	1	CG
<i>Thienemannimyia</i> Gr.	2	0.66	6	PR
Total Chironomidae	169	55.96		
Grand Total	302	100.00		

Aquatic Invertebrate Summary Data

Site Name: Six Mile Creek **Site ID: S-1 7/9/01**

TOTAL ABUNDANCE 302
 Ephemeroptera + Plecoptera +
 Trichoptera (EPT) abundance 45

TOTAL NUMBER OF TAXA 27
 Number EPT taxa 12

TAXONOMIC GROUP COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Misc. Taxa	3	25	8.28
Odonata	0	0	0.00
Ephemeroptera	7	20	6.62
Plecoptera	1	2	0.66
Hemiptera	0	0	0.00
Megaloptera	0	0	0.00
Trichoptera	4	23	7.62
Lepidoptera	0	0	0.00
Coleoptera	3	60	19.87
Diptera	1	3	0.99
Chironomidae	8	169	55.96

RATIOS OF TAX GROUP ABUNDANCES

EPT/Chironomidae 0.27

FUNCTIONAL FEEDING GROUP (FFG) COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Predator	4	14	4.64
Parasite	1	2	0.66
Collector-gatherer	14	239	79.14
Collector-filterer	0	0	0.00
Macrophyte-herbivore	0	0	0.00
Piercer-herbivore	2	16	5.30
Scraper	4	19	6.29
Shredder	0	0	0.00
Xylophage	0	0	0.00
Omnivore	2	12	3.97
Unknown	0	0	0.00

RATIOS OF FFG ABUNDANCES

Scraper/Collector-filterer #DIV/0!
 Scraper/(Scraper + C.filterer) 1.00
 Shredder/Total organisms 0.00

CONTRIBUTION OF DOMINANT TAXA

TAXON	ABUNDANCE	PERCENT
<i>Cricotopus</i> sp.	140	46.36
<i>Zaitzevia</i> sp.	43	14.24
<i>Optioservus</i> sp.	15	4.97
Enchytraeidae	13	4.30
<i>Ochrotrichia</i> sp.	13	4.30
SUBTOTAL 5 DOMINANTS	224	74.17
<i>Eukiefferiella</i> Gracei Gr.	11	3.64
<i>Polycelis coronata</i>	10	3.31
<i>Serratella tibialis</i>	10	3.31
<i>Rhyacophila</i> Brunnea Gr.	7	2.32
<i>Orthocladus</i> sp.	6	1.99
TOTAL DOMINANTS	268	88.74

SAPROBIC INDICES

Hilsenhoff Biotic Index 5.23

DIVERSITY MEASURES

Shannon H (log_e) 1.76
 Shannon H (log₂) 2.54
 Evenness 0.53
 Simpson D 0.20

COMMUNITY VOLTINISM ANALYSIS

TYPE	ABUNDANCE	PERCENT
Multivoltine	152	50.17
Univoltine	86	28.48
Semivoltine	65	21.36

	#TAXA	ABUNDANCE	PERCENT
Tolerant	3	71	23.51
Intolerant	1	3	0.99
Clinger	14	239	79.14

Aquatic Invertebrate Taxonomic Data

Site Name: Six Mile Creek

Site ID: S-2 7/9/01

Approx. percent of sample used: 40

Taxon	Quantity	Percent	HBI	FFG
<i>Polycelis coronata</i>	1	0.33	4	CG
Tubificidae - immature	2	0.65	9	CG
Total Misc. Taxa	3	0.98		
<i>Centroptilum</i> sp.	2	0.65	2	CG
<i>Dipheter hageni</i>	3	0.98	5	CG
<i>Drunella coloradensis</i>	2	0.65	0	CG
<i>Serratella tibialis</i>	6	1.96	2	CG
<i>Timpanoga hecuba</i>	1	0.33	7	CG
Total Ephemeroptera	14	4.58		
<i>Zapada cinctipes</i>	1	0.33	2	SH
<i>Kogatus</i> sp.	1	0.33	2	PR
Total Plecoptera	2	0.65		
<i>Agapetus</i> sp.	1	0.33	0	SC
<i>Ochrotrichia</i> sp.	8	2.61	4	PH
<i>Lepidostoma</i> sp.-turret case larvae	1	0.33	2	SH
<i>Rhyacophila Brunnea</i> Gr.	10	3.27	1	PR
Total Trichoptera	20	6.54		
<i>Heterlimnius</i> sp.	16	5.23	4	CG
<i>Lara avara</i>	1	0.33	4	SH
<i>Optioservus</i> sp.	30	9.80	4	SC
<i>Zaitzevia</i> sp.	42	13.73	4	CG
Total Coleoptera	89	29.08		
Ceratopogoninae	2	0.65	6	PR
<i>Chelifera</i> sp.	1	0.33	6	PR
Total Diptera	3	0.98		
<i>Cricotopus Trifascia</i> Gr.	3	0.98	6	CG
<i>Eukiefferiella Pseudomontana</i> Gr.	1	0.33	8	OM
<i>Micropsectra</i> sp.	21	6.86	7	CG
<i>Orthocladius</i> sp.	146	47.71	6	CG
<i>Pagastia</i> sp.	2	0.65	1	CG
<i>Stempellinella</i> sp.	1	0.33	4	UN
<i>Thienemannimyia</i> Gr.	1	0.33	6	PR
Total Chironomidae	175	57.19		
Grand Total	306	100.00		

Aquatic Invertebrate Summary Data

Site Name: Six Mile Creek

Site ID: S-2 7/9/01

TOTAL ABUNDANCE 306
 Ephemeroptera + Plecoptera +
 Trichoptera (EPT) abundance 36

TOTAL NUMBER OF TAXA 26
 Number EPT taxa 11

TAXONOMIC GROUP COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Misc. Taxa	2	3	0.98
Odonata	0	0	0.00
Ephemeroptera	5	14	4.58
Plecoptera	2	2	0.65
Hemiptera	0	0	0.00
Megaloptera	0	0	0.00
Trichoptera	4	20	6.54
Lepidoptera	0	0	0.00
Coleoptera	4	89	29.08
Diptera	2	3	0.98
Chironomidae	7	175	57.19

RATIOS OF TAX GROUP ABUNDANCES

EPT/Chironomidae 0.21

FUNCTIONAL FEEDING GROUP (FFG) COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Predator	5	15	4.90
Parasite	0	0	0.00
Collector-gatherer	13	247	80.72
Collector-filterer	0	0	0.00
Macrophyte-herbivore	0	0	0.00
Piercer-herbivore	1	8	2.61
Scraper	2	31	10.13
Shredder	3	3	0.98
Xylophage	0	0	0.00
Omnivore	1	1	0.33
Unknown	1	1	0.33

RATIOS OF FFG ABUNDANCES

Scraper/Collector-filterer #DIV/0!
 Scraper/(Scraper + C.filterer) 1.00
 Shredder/Total organisms 0.00

CONTRIBUTION OF DOMINANT TAXA

TAXON	ABUNDANCE	PERCENT
<i>Orthocladus</i> sp.	146	47.71
<i>Zaitzevia</i> sp.	42	13.73
<i>Optioservus</i> sp.	30	9.80
<i>Micropsectra</i> sp.	21	6.86
<i>Heterlimnius</i> sp.	16	5.23
SUBTOTAL 5 DOMINANTS	255	83.33
Rhyacophila Brunnea Gr.	10	3.27
<i>Ochrotrichia</i> sp.	8	2.61
<i>Serratella tibialis</i>	6	1.96
<i>Dipheter hageni</i>	3	0.98
Cricotopus Trifascia Group	3	0.98
TOTAL DOMINANTS	285	93.14

SAPROBIC INDICES

Hilsenhoff Biotic Index 5.04

DIVERSITY MEASURES

Shannon H (log_e) 1.58
 Shannon H (log₂) 2.28
 Evenness 0.48
 Simpson D 0.22

COMMUNITY VOLTINISM ANALYSIS

TYPE	ABUNDANCE	PERCENT
Multivoltine	142	46.41
Univoltine	70	22.88
Semivoltine	94	30.72

	#TAXA	ABUNDANCE	PERCENT
Tolerant	5	83	27.12
Intolerant	1	1	0.33
Clinger	12	121	39.54

Aquatic Invertebrate Taxonomic Data

Site Name: Pettengill Creek

Site ID: P-2 7/11/01

Approx. percent of sample used: 100

Taxon	Quantity	Percent	HBI	FFG
Naididae	1	0.59	8	CG
Sphaeriidae	1	0.59	8	CG
Physidae	1	0.59	8	CG
Acari	1	0.59	5	PA
Total Misc. Taxa	4	2.35		
<i>Drunella coloradensis</i>	1	0.59	0	CG
<i>Ephemerella</i> sp.	1	0.59	1	CG
<i>Serratella tibialis</i>	1	0.59	2	CG
<i>Ameletus</i> sp.	1	0.59	0	CG
Total Ephemeroptera	4	2.35		
<i>Sweltsa</i> sp.	1	0.59	1	PR
<i>Calineuria californica</i>	1	0.59	2	PR
<i>Kogotus</i> sp.	1	0.59	2	PR
Total Plecoptera	3	1.76		
<i>Trichocorixa</i> sp.	1	0.59	8	PR
Total Hemiptera	1	0.59		
<i>Amiocentrus aspilus</i>	6	3.53	3	CG
<i>Brachycentrus americanus</i>	6	3.53	1	OM
<i>Micrasema</i> sp.	16	9.41	1	MH
<i>Lepidostoma</i> sp.-sand case larvae	10	5.88	1	SH
<i>Neophylax rickeri</i>	3	1.76	2	SC
Total Trichoptera	41	24.12		
Dytiscidae	12	7.06	5	PR
<i>Cleptelmis</i> sp.	17	10.00	4	CG
<i>Optioservus</i> sp.	26	15.29	4	SC
Total Coleoptera	55	32.35		
<i>Atherix</i> sp.	1	0.59	4	PR
<i>Chelifera</i> sp.	1	0.59	6	PR
<i>Simulium</i> sp.	1	0.59	6	CF
<i>Antocha</i> sp.	2	1.18	3	CG
Total Diptera	5	2.94		
<i>Brillia</i> sp.	1	0.59	5	SH
<i>Cricotopus</i> (Isocladius) Gr.	14	8.24	7	CG
<i>Micropsectra</i> sp.	32	18.82	7	CG
<i>Pagastia</i> sp.	2	1.18	1	CG
<i>Thienemanniella</i> sp.	4	2.35	6	CG
<i>Thienemannimyia</i> Gr.	3	1.76	6	PR
<i>Tvetenia</i> sp.	1	0.59	5	CG
Total Chironomidae	57	33.53		
Grand Total	170	100.00		

Aquatic Invertebrate Summary Data

Site Name: Pettengill Creek **Site ID: P-2 7/11/01**

TOTAL ABUNDANCE	170
Ephemeroptera + Plecoptera + Trichoptera (EPT) abundance	48
TOTAL NUMBER OF TAXA	31
Number EPT taxa	12

TAXONOMIC GROUP COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Misc. Taxa	4	4	2.35
Odonata	0	0	0.00
Ephemeroptera	4	4	2.35
Plecoptera	3	3	1.76
Hemiptera	1	1	0.59
Megaloptera	0	0	0.00
Trichoptera	5	41	24.12
Lepidoptera	0	0	0.00
Coleoptera	3	55	32.35
Diptera	4	5	2.94
Chironomidae	7	57	33.53

RATIOS OF TAX GROUP ABUNDANCES

EPT/Chironomidae	0.84
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FUNCTIONAL FEEDING GROUP (FFG) COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Predator	8	21	12.35
Parasite	1	1	0.59
Collector-gatherer	15	85	50.00
Collector-filterer	1	1	0.59
Macrophyte-herbivore	1	16	9.41
Piercer-herbivore	0	0	0.00
Scraper	2	29	17.06
Shredder	2	11	6.47
Xylophage	0	0	0.00
Omnivore	1	6	3.53
Unknown	0	0	0.00

RATIOS OF FFG ABUNDANCES

Scraper/Collector-filterer	29.00
Scraper/(Scraper + C.filterer)	0.97
Shredder/Total organisms	0.04

CONTRIBUTION OF DOMINANT TAXA

TAXON	ABUNDANCE	PERCENT
<i>Microsectra</i> sp.	32	18.82
<i>Optioservus</i> sp.	26	15.29
<i>Cleptelmis</i> sp.	17	10.00
<i>Micrasema</i> sp.	16	9.41
Cricotopus (Isocladus) Gr.	14	8.24
SUBTOTAL 5 DOMINANTS	105	61.76
Dytiscidae	12	7.06
<i>Lepidostoma</i> sp.-sand case larv.	10	5.88
<i>Amiocentrus aspilus</i>	6	3.53
<i>Brachycentrus americanus</i>	6	3.53
Thienemanniella sp.	4	2.35
TOTAL DOMINANTS	143	84.11

SAPROBIC INDICES

Hilsenhoff Biotic Index	4.30
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DIVERSITY MEASURES

Shannon H (log _e)	2.34
Shannon H (log ₂)	3.37
Evenness	0.68
Simpson D	0.10

COMMUNITY VOLTINISM ANALYSIS

TYPE	ABUNDANCE	PERCENT
Multivoltine	44	25.74
Univoltine	64	37.50
Semivoltine	63	36.76

	#TAXA	ABUNDANCE	PERCENT
Tolerant	4	56	32.94
Intolerant	1	1	0.59
Clinger	14	96	56.47

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